

IMPERIAL COUNTY AIR POLLUTION CONTROL DISTRICT



**August 9, 2016
Exceptional Event Documentation
For the Imperial County PM₁₀ Nonattainment Area**

FINAL DRAFT
December 11, 2018

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ACRONYM DESCRIPTIONS

AOD	Aerosol Optical Depth
AQI	Air Quality Index
AQS	Air Quality System
BACM	Best Available Control Measures
BAM 1020	Beta Attenuation Monitor Model 1020
BLM	United States Bureau of Land Management
BP	United States Border Patrol
CAA	Clean Air Act
CARB	California Air Resources Board
CMP	Conservation Management Practice
DCP	Dust Control Plan
DPR	California Department of Parks and Recreation
EER	Exceptional Events Rule
EPA	Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
GOES-W/E	Geostationary Operational Environmental Satellite (West/East)
HC	Historical Concentrations
HYSPLIT	Hybrid Single Particle Lagrangian Integrated Trajectory Model
ICAPCD	Imperial County Air Pollution Control District
INPEE	Initial Notification of a Potential Exceptional Event
ITCZ	Inter Tropical Convergence Zone
KBLH	Blythe Airport
KCZZ	Campo Airport
KIPL	Imperial County Airport
KNJK	El Centro Naval Air Station
KNYL/MCAS	Yuma Marine Corps Air Station
KPSP	Palm Springs International Airport
KTRM	Jacqueline Cochran Regional Airport (aka Desert Resorts Rgnl Airport)
PST	Local Standard Time
MMML/MXL	Mexicali, Mexico Airport
MODIS	Moderate Resolution Imaging Spectroradiometer
MPH	Miles Per Hour
MST	Mountain Standard Time
NAAQS	National Ambient Air Quality Standard
NCAR	National Center for Atmospheric Research
NCEI	National Centers for Environmental Information
NEAP	Natural Events Action Plan
NEXRAD	Next-Generation Radar
NOAA	National Oceanic and Atmospheric Administration

nRCP	Not Reasonably Controllable or Preventable
NWS	National Weather Service
PDT	Pacific Daylight Time
PM ₁₀	Particulate Matter less than 10 microns
PM _{2.5}	Particulate Matter less than 2.5 microns
PST	Pacific Standard Time
QA/QC	Quality Assured and Quality Controlled
QCLCD	Quality Controlled Local Climatology Data
RACM	Reasonable Available Control Measure
RAWS	Remote Automated Weather Station
SIP	State Implementation Plan
SLAMS	State Local Ambient Air Monitoring Station
SMP	Smoke Management Plan
SSI	Size-Selective Inlet
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTC	Coordinated Universal Time
WRCC	Western Regional Climate Center

I Introduction

On August 9, 2016, State and Local Ambient Air Monitoring Stations (SLAMS), located in Calexico (AQS Site Code 060250005), El Centro (AQS Site Code 060251003), Niland (060254004), and Westmorland (AQS Site Code 060254003) California, measured an exceedance of the National Ambient Air Quality Standard (NAAQS). The Federal Equivalent Method (FEM), Beta Attenuation Monitor Model 1020 (BAM 1020) measured (midnight to midnight) 24-hr average Particulate Matter less than 10 microns (PM₁₀) concentrations of 155 µg/m³, 159 µg/m³, 167 µg/m³, and 166 µg/m³ (**Table 1-1**). PM₁₀ 24-hr measurements above 150 µg/m³ are exceedances of the NAAQS. Four of the five SLAMS located in Imperial County measured an exceedance of the PM₁₀ NAAQS on August 9, 2016.

TABLE 1-1
CONCENTRATIONS OF PM₁₀ ON AUGUST 9, 2016

DATE	MONITORING SITE	AQS ID	POC(s)	HOURS	24-HOUR CONCENTRATION µg/m ³	PM ₁₀ NAAQS µg/m ³
8/9/2016	Calexico	06-025-0005	3	24	155	150
8/9/2016	El Centro	06-025-1003	4	24	159	150
8/9/2016	Niland	06-025-4004	3	24	167	150
8/9/2016	Westmorland	06-025-4003	3	24	166	150
8/9/2016	Brawley	06-025-0007	3	24	141	150

*All time referenced throughout this document is in Pacific Standard Time (PST) unless otherwise noted¹

The Imperial County Air Pollution Control District (ICAPCD) has been submitting PM₁₀ data from Federal Reference Method (FRM) Size Selective Inlet (SSI) instruments since 1986 into the United States Environmental Protection Agency's (USEPA) Air Quality System (AQS). Prior to 2013 all continuous measured PM₁₀ data was non-regulatory, thus measured in local conditions. However, by 2013 ICAPCD began formally submitting continuous FEM PM₁₀ data from BAM 1020's into the USEPA managed AQS. Because regulatory consideration of reported data must be in standard conditions, as required by USEPA, all continuous PM₁₀ data since 2013 is regulatory. On August 9, 2016, four of the five air monitors, except Brawley, within Imperial County were impacted by elevated particulate matter caused by the transport of fugitive windblown dust from high winds associated with a monsoonal "Gulf Surge" that pushed northwards out of Mexico into southern Arizona and southeast California during August 9, 2016.

This report demonstrates that a naturally occurring event caused an exceedance observed on August 9, 2016, which elevated particulate matter and affected air quality. The report provides concentration to concentration monitoring site analyses supporting a clear causal relationship between the event and the monitored exceedance and provides an analysis supporting the not

¹ According to the National Institute of Standards and Technology (NIST) Time and Frequency Division the designation of the time of day for specific time zones are qualified by using the term "standard time" or "daylight time". For year-round use the designation can be left off inferring "local time" daylight or standard whichever is present. For 2015 Pacific Daylight Time (PDT) is March 13 to November 6. <https://www.nist.gov/pml/time-and-frequency-division/local-time-faqs#int1>

reasonably controllable or preventable (nRCP) criteria. Furthermore, the report provides information that the exceedance would not have occurred without the transport of windblown dust from outlying natural open deserts and mountains within the Sonoran Desert, which includes Mexico and Arizona. The document further substantiates the request by the ICAPCD to exclude PM₁₀ 24-hour NAAQS exceedances of 155 µg/m³, 159 µg/m³, 167 µg/m³, and 166 µg/m³ (**Table 1-1**) as an exceptional event. This demonstration substantiates that this event meets the definition of the USEPA Regulation for the Treatment of Data Influenced by Exceptional Events (EER).²

I.1 Demonstration Contents

Section II - Describes the August 9, 2016 event as it occurred in Arizona, California and Imperial County, providing background information of the exceptional event and explaining how the wind driven emissions from the event led to the exceedance at the Calexico, El Centro, Niland, and Westmorland monitors.

Section III – Using time-series graphs, summaries and historical concentration comparisons of the Calexico, El Centro, Niland, and Westmorland stations this section discusses and establishes how the August 9, 2016 event affected air quality such that a clear causal relationship is demonstrated between the event and the monitored exceedance. It is perhaps of some value to mention that the time-series graphs include PM₁₀ data measured in both local conditions and standard conditions. Measured PM₁₀ continuous data prior to 2013 is in local conditions, all other data is in standard conditions. The concentration difference between local and standard conditions has an insignificant impact on any data analysis. Overall, this section provides the evidence that human activity played little or no direct causal role in the August 9, 2016 event and its resulting emissions defining the event as a “natural event”.³

Section IV - Provides evidence that the event of August 9, 2016 was not reasonably controllable or preventable despite the full enforcement and implementation of Best Available Control Measures (BACM).

Section V - Brings together the evidence presented within this report to show that the exceptional event affected air quality; that the event was not reasonably controllable or preventable; that there was a clear causal relationship between the event and the exceedance, and that the event was a natural event.

² "Treatment of Data Influenced by Exceptional Events; Final Guidance", 81 FR 68216, October 2, 2016

³ Title 40 Code of Federal Regulations part 50: §50.1(k) Natural event means an event and its resulting emissions, which may recur at the same location, in which human activity plays little or no direct causal role. For purposes of the definition of a natural event, anthropogenic sources that are reasonably controlled shall be considered to not play a direct role in causing emissions.

I.2 Requirement of the Exceptional Event Rule

The above sections combined comprise the technical requirements described under the Exceptional Events Rule (EER) under 40 CFR §50.14(c)(3)(iv). However, in order for the USEPA to concur with flagged air quality monitoring data, there are additional non-technical requirements.

I.2.a Public Notification that a potential event was occurring (40 CFR §50.14(c)(1))

Although the ICAPCD published, the National Weather Service (NWS) forecast for August 9, 2016, notification of the return of monsoon storms were issued as early as August 7, 2016. The weekend forecast included a discussion of a series of upper-level troughs dominating the weather pattern over Southwest California, which would keep any monsoonal moisture to the east well out of the San Diego forecast area. The Phoenix NWS office concentrated its forecast discussions primarily for Arizona, specifically Maricopa County. According to the Phoenix office, convection got off to an early start across the Phoenix metro area and scattered activity would persist in Maricopa County before spreading eastward.

The published notification, via the ICAPCD's webpage, forecast for August 9, 2016 included the synopsis for the San Diego and Phoenix NWS offices. Along the coast and mountain ranges to the west of Imperial County, the San Diego NWS office identified a trough of low-pressure that would keep a dry southwest flow aloft. In addition, below average temperatures over much of Southern California through Thursday was expected. This is significant because as the cooler temperatures remain in place along the West Coast, any potential for surges related to thunderstorm activity would be non-existent. The weather story issued by the San Diego NWS office identified no significant impacts from Javier (tropical depression) expected for Southwest California. However, the San Diego office discussed the slow movement up the Baja California coast of tropical depression Javier before dissipating by Wednesday, August 10, 2016. The tropical moisture was forecast to move up the Baja California coast and east into central Arizona.

To the east of Imperial County, the Phoenix NWS office issued a forecast of a return to more extensive thunderstorm activity over central and eastern Arizona through Thursday. The Phoenix NWS identified moisture moving into Arizona and explained that any storms that would develop would have the potential for strong winds and heavy rain along the southern and central parts of Arizona.

The daily burn assessment for August 9, 2016 by ICAPCD staff identified hazy conditions and a high dew point, which provided conditions for a Marginal Green Waste burn day, no other burning was allowed. **Appendix A** contains copies of notices pertinent to the August 9, 2016 event.

I.2.b Initial Notification of Potential Exceptional Event (INPEE) (40 CFR §50.14(c)(2))

States are required under federal regulation to submit measured ambient air quality data into the AQS. AQS is the federal repository of Quality Assured and Quality Controlled (QA/QC)

ambient air data used for regulatory purposes. When States intend to request the exclusion of one or more exceedances of a NAAQS as an exceptional event a notification to the Administrator is required. The notification is accomplished by flagging the data in AQS and providing an initial event description.

On October 3, 2016, the US EPA promulgated revisions to the Exceptional Events rule, which included the requirement of an “Initial Notification of Potential Exceptional Event” (INPEE) process. This revised INPEE process requires communication between the US EPA regional office and the State, prior to the development of a demonstration. The intent of the INPEE process is twofold: to determine whether identified data may affect a regulatory decision and whether a State should develop/submit an EE Demonstration.

The ICAPCD made a formal written request to the California Air Resources Board (CARB) to place preliminary flags on SLAMS measured PM₁₀ concentrations from the Brawley, Calexico, El Centro, and Westmorland monitors on April 17, 2017. The INPEE, for the August 9, 2016 event, was formally submitted by the CARB to USEPA Region 9 on April 24, 2017. Subsequently there after a second revised request to CARB requested preliminary flags on additional days for 2016. **Table 1-1** above provides the PM₁₀ measured concentrations for all monitors in Imperial County for August 9, 2016. A brief description of the meteorological conditions provided to CARB, provided preliminary information that indicated a potential natural event had occurred on August 9, 2016.

I.2.c Documentation that the public comment process was followed for the event demonstration that was flagged for exclusion (40 CFR §50.14(c)(3)(v))

The ICAPCD posted, for a 30-day public review, a draft version of this demonstration on the ICAPCD webpage and published a notice of availability in the Imperial Valley Press on June 28, 2018. The notice advised the public that comments were being solicited regarding this demonstration, which supports the request, by the ICAPCD, to exclude the measured concentrations of 155 µg/m³, 159 µg/m³, 167 µg/m³, and 166 µg/m³, which occurred on August 9, 2016 in Brawley, Calexico, El Centro, Niland, and Westmorland (**Table 1-1**). The final closing date for comments was July 30, 2018. **Appendix A** contains a copy of the public notice affidavit along with any comments received by the ICAPCD for submittal as part of the demonstration (40 CFR §50.14(c)(3)(v)).

I.2.d Documentation submittal supporting an Exceptional Event Flag (40 CFR §50.14(c)(3)(i))

States that have flagged data as a result of an exceptional event and who have requested an exclusion of said flagged data are required to submit a demonstration that justifies the data exclusion to the USEPA in accordance with the due date established by USEPA during the INPEE process (40 CFR §50.14(c)(2)). Currently, bi-weekly meetings between USEPA, CARB and Imperial County are set to discuss each flagged exceedance for 2016.

The ICAPCD, after the close of the comment period and after consideration of the comments will submit this demonstration along with all required elements, including received comments and

responses to USEPA Region 9 in San Francisco, California. The submittal of the August 9, 2016 demonstration will have a regulatory impact upon the development and ultimate submittal of the PM₁₀ State Implementation Plan for Imperial County in 2018.

I.2.e Necessary demonstration to justify an exclusion of data under (40 CFR§50.14(c)(3)(iv))

- A This demonstration provides evidence that the event, as it occurred on August 9, 2016, satisfies the definition in 40 CFR §50.1(j) and (k) for an exceptional event.
 - a The event created the meteorological conditions that entrained emissions and caused the exceedance.
 - b The event clearly “affects air quality” such that there is the existence of a clear causal relationship between the event and the exceedance.
 - c Analysis demonstrates that the event-influenced concentrations compared to concentrations at the same monitor at other times supports the clear causal relationship.
 - d The event “is not reasonably controllable and not reasonably preventable.”
 - e The event is “caused by human activity that is unlikely to recur at a particular location or [is] a natural event.”
 - f The event is a “natural event” where human activity played little or no direct causal role.
- B This demonstration provides evidence that the exceptional event affected air quality in Imperial County by demonstrating a clear causal relationship between the event and the measured concentrations in Brawley, Calexico, El Centro, and Westmorland.
- C This demonstration provides evidence of the measured concentrations to concentrations at the same monitor at other times supporting the clear causal relationship between the event and the affected monitor.

II August 9, 2016 Conceptual Model

This section provides a summary description of the meteorological and air quality conditions under which the August 9, 2016 event unfolded in Imperial County. The subsection elements include

- » A description and map of the geographic setting of the air quality and meteorological monitors
- » A description of Imperial County's climate
- » An overall description of meteorological and air quality conditions on the event day.

II.1 Geographic Setting and Monitor Locations

According to the United States Census Bureau, Imperial County has a total area of 4,482 square miles of which 4,177 square miles is land and 305 square miles is water. Much of Imperial County is below sea level and is part of the Colorado Desert an extension of the larger Sonoran Desert (Figure 2-1). The Colorado Desert not only includes Imperial County but a portion of San Diego County.

**FIGURE 2-1
COLORADO DESERT AREA IMPERIAL COUNTY**



Fig 2-1: 1997 California Environmental Resources Evaluation System. According to the United States Geological Survey (USGS) Western Ecological Research Center the Colorado Desert bioregion is part of the bigger Sonoran Desert Bioregion which includes the Colorado Desert and Upper Sonoran Desert sections of California and Arizona, and a portion of the Chihuahuan Basin and Range Section in Arizona and New Mexico (Forest Service 1994)

A notable feature in Imperial County is the Salton Sea, which is at approximately 235 feet below sea level. The Chocolate Mountains are located east of the Salton Sea and extend in a northwest-southeast direction for approximately 60 miles (**Figure 2-2**). In this region, the geology is dominated by the transition of the tectonic plate boundary from rift to fault. The southernmost strands of the San Andreas Fault connect the northern-most extensions of the East Pacific rise. Consequently, the region is subject to earthquakes and the crust is being stretched, resulting in a sinking of the terrain over time.

FIGURE 2-2
SURROUNDING AREAS OF THE SALTON SEA



Fig 2-2: Image courtesy of the Image Science and Analysis Laboratory NASA Johnson Space Center, Houston Texas

All of the seven incorporated cities, including the unincorporated township of Niland, are surrounded by agricultural fields to the north, east, west and south (**Figure 2-6**). Together, the incorporated cities, including Niland, and the agricultural fields make what is known as the Imperial Valley. Surrounding the Imperial Valley are desert areas found on the eastern and western portions of Imperial County.

The desert area, found within the western portion of Imperial County is of note because of its border with San Diego County. From west to east, San Diego County stretches from the Pacific Ocean to its boundary with Imperial County. San Diego County has a varied topography. On its western side is 70 miles (110 km) of coastline. Most of San Diego between the coast and the Laguna Mountains consists of hills, mesas, and small canyons. Snow-capped (in winter)

mountains rise to the northeast, with the Sonoran Desert to the far east. Cleveland National Forest is spread across the central portion of the county, while the Anza-Borrego Desert State Park occupies most of the northeast. The southeastern portion of San Diego County is comprised of distinctive Peninsular mountain ranges. The mountains and deserts of San Diego comprise the eastern two-thirds of San Diego County and are primarily undeveloped back country with a native plant community known as chaparral. Of the nine major mountain ranges within San Diego County, the In-Ko-Pah Mountains and the Jacumba Mountains border Mexico and Imperial County.

Both mountain ranges provide the distinctive weathered dramatic piles of residual boulders that can be seen while driving Interstate 8 from Imperial County through Devil's Canyon and In-Ko-Pah Gorge. Interstate 8 runs along the US border with Mexico from San Diego's Mission Bay to just southeast of Casa Grande Arizona.

FIGURE 2-3
JACUMBA PEAK



Fig 2-3: The Jacumba Mountains reach an elevation of 4,512 feet (1,375 m) at Jacumba Peak, near the southern end of the chain. Source: Wikipedia at https://en.wikipedia.org/wiki/Jacumba_Mountains

Northwest and northeast of the Jacumba Mountains is the Tierra Blanca Mountains, the Sawtooth Mountains and Anza-Borrego Desert State Park. Within the mountain ranges and the Anza-Borrego Desert State Park, there exists the Vallecito Mountains, the Carrizo Badlands, the Carrizo Impact Area, Coyote Mountains and the Volcanic Hills to name of few. Characteristically, these areas all have erosion that has occurred over time that extends from the Santa Rosa Mountains into northern Baja California in Mexico. For example, the Coyote Mountains consists of sand dunes left over from the ancient inland Sea of Cortez. Much of the terrain is still loose dirt, interspersed with sandstone and occasional quartz veins. The nearest community to the Coyote Mountain range is the community of Ocotillo. Of interest are the fossilized and hollowed out sand dunes that produce wind caves.

FIGURE 2-4
ANZA-BORREGO DESERT STATE PARK
CARRIZO BADLANDS



Fig 2-4: View southwest across the Carrizo Badlands from the Wind Caves in Anza-Borrego Desert State Park. Source: Wikipedia at https://en.wikipedia.org/wiki/Carrizo_Badlands

The Carrizo Badlands, which includes the Carrizo Impact Area used by the US Navy as an air-to-ground bombing range during World War II and the Korean War, lies within the Anza-Borrego Desert State Park. The Anza-Borrego Desert State Park is located within the Colorado Desert, is the largest state park in California occupying eastern San Diego County, reaching into Imperial and Riverside counties. The two communities within Anza-Borrego Desert State Park are Borrego Springs and Shelter Valley.

The Anza-Borrego Desert State Park lies in a unique geologic setting along the western margin of the Salton Trough. The area extends north from the Gulf of California to San Geronio Pass and from the eastern rim of the Peninsular Ranges eastward to the San Andreas Fault zone along the far side of the Coachella Valley. The Anza-Borrego region changed gradually over time from intermittently being fed by the Colorado River Delta to dry lakes and erosion from the surrounding mountain ranges. The area located within the southeastern and northeastern section of San Diego County is a source of entrained fugitive dust emissions that impact Imperial County when westerly winds funnel through the unique landforms causing in some cases wind tunnels that cause increases in wind speeds.

Historical observations have indicated that the desert slopes and mountains of San Diego are a source of fugitive emissions along with those deserts located to the east and west of Imperial County, which extend into Mexico (Sonoran Desert, **Figure 2-7**). Combined, the desert areas and mountains of San Diego and the desert areas that extend into Mexico are sources of dust emissions, which affect the Imperial County during high wind events.

FIGURE 2-5
ANZA-BORREGO DESERT STATE PARK
DESERT VIEW FROM FONT'S POINT



Fig 2-5: Desert view from Font's Point. Source: Font's Point Anza-Borrego Photographed by and copyright of (c) David Corby; Wikipedia at https://en.wikipedia.org/wiki/Anza-Borrego_Desert_State_Park

FIGURE 2-6
LOCATION AND TOPOGRAPHY OF IMPERIAL COUNTY



Fig 2-6: Depicts the seven incorporated cities within Imperial Valley - City of Calipatria, City of Westmorland, City of Brawley, City of Imperial, City of El Centro, City of Holtville, City of Calexico. Niland is unincorporated. Mexicali, Mexico is to the south

FIGURE 2-7
DESERTS IN CALIFORNIA, YUMA AND MEXICO

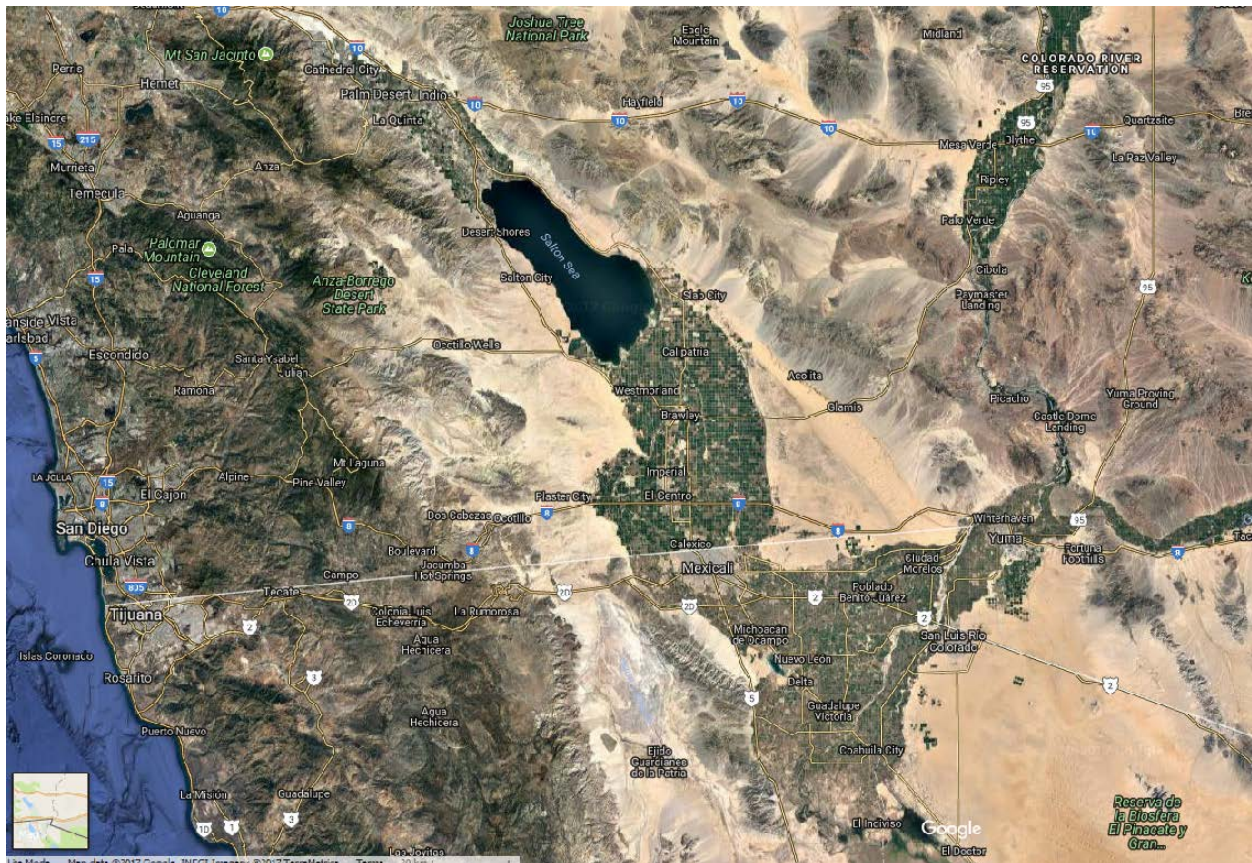


Fig 2-7: Depicts the Sonoran Desert as it extends from Mexico into Imperial County.

Source: Google Earth Terra Metrics

The air quality and meteorological monitoring stations used in this demonstration are shown in **Figure 2-8**. Of the five SLAMS within Imperial County four stations measure both meteorological and air quality data. These SLAMS are located in Calexico, El Centro, Westmorland, and Niland; the station located in Brawley only measures air quality. Other air monitoring stations measuring air quality and meteorological data used for this demonstration include stations in eastern Riverside County, southeastern San Diego County and southwestern Arizona (Yuma County) (**Figure 2-8 and Table 2-1**).

As mentioned above, the PM_{10} exceedance on August 9, 2016, occurred at the Calexico, El Centro, Niland and Westmorland stations. The Brawley, Niland, and Westmorland stations are regarded as the “northern” monitoring sites within the Imperial County air monitoring network. In order to properly analyze the contributions from meteorological conditions occurring on August 9, 2016, other meteorological sites were used in this demonstration which include airports in eastern Riverside County, southeastern San Diego County, southwestern Arizona (Yuma County), Imperial County, and other sites relevant to the wind event, such as within northern Mexico. (**Figure 2-8 and Appendix B**).

FIGURE 2-8
MONITORING SITES IN AND AROUND IMPERIAL COUNTY

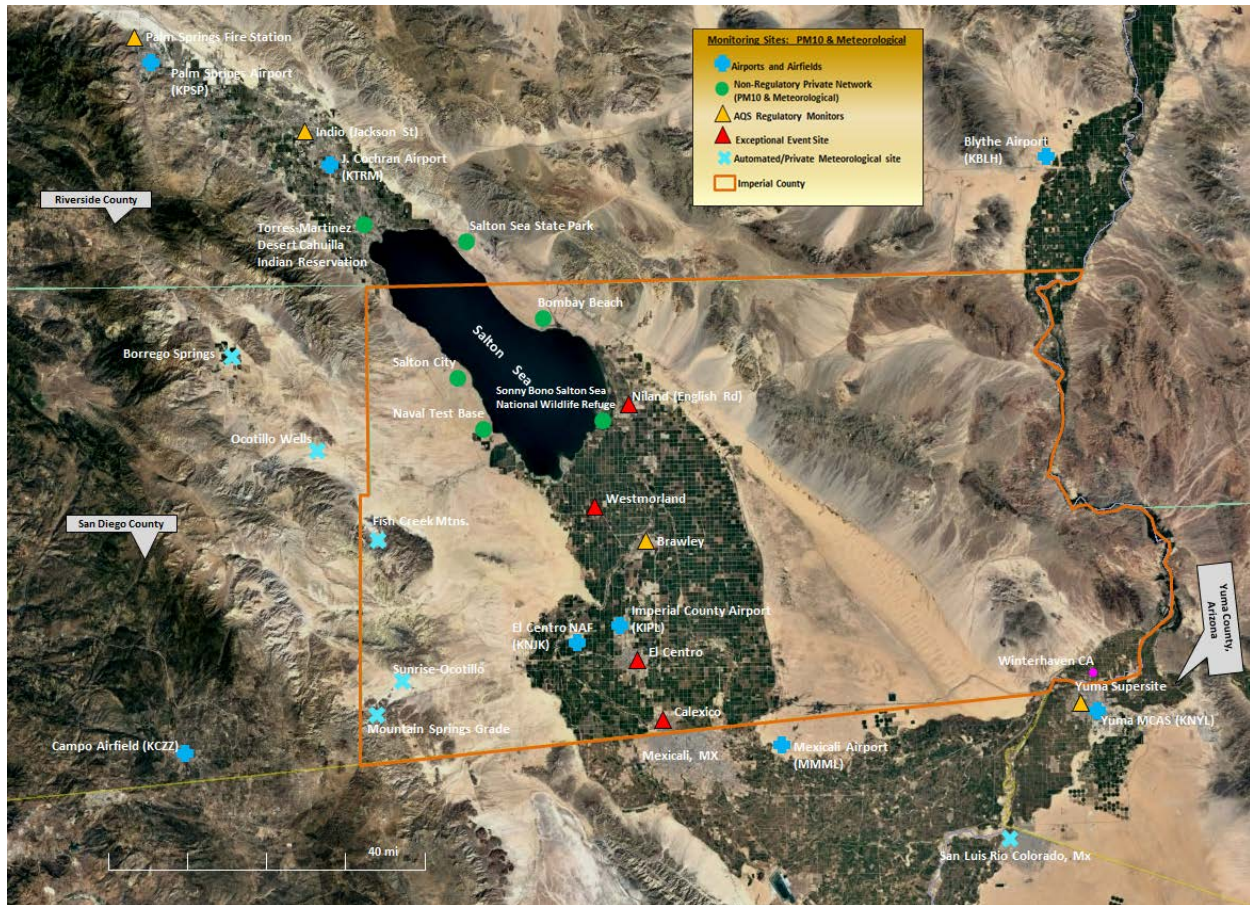


Fig 2-8: Depicts a select group of meteorological and PM₁₀ monitoring sites in Imperial County, eastern Riverside County, southeastern San Diego County, southwestern Arizona (Yuma County), and northern Mexico. The image provides the location of potential sites used to gather data in support an Exceptional Event Demonstration. Source: Google Earth

In addition to meteorological sites, there are non-regulatory PM₁₀ sites located around the Salton Sea that maybe referenced as an aid to help the reader understand the direction and velocity of winds that affect Imperial County. Unless, otherwise specifically indicated concentration references do not imply emissions from the surrounding playa of the Salton Sea. Three sites, in specific, are the Salton City air monitoring station, the Naval Test Base air monitoring station and the Sonny Bono air monitoring station. These privately owned and non-regulatory stations are located closest to the Imperial County air monitoring network (**Figures 2-9 to 2-12**). The Salton City station is located 33.27275°N latitude and 115.90062°W longitude, on the western edge of the Salton Sea (**Figure 2-9**). The station abuts a water reservoir along the Salton Sea with surrounding chaparral vegetation and unpaved open areas and roads. The Naval Test Base station is located 33.16923°N latitude and 115.85593°W longitude, on the southwestern edge of the Salton Sea (**Figure 2-11**). The station sits on an abandoned US Military site, still owned by the Department of Defense. Unlike the Salton City station, light chaparral vegetation and sandy open

dune areas surround the Naval Test Base station. Directly to the west of the station is an orchard. The Sonny Bono station is located 33.17638°N latitude and 115.62310°W longitude, on the southern portion of the Salton Sea within the Sonny Bono Salton Sea Wildlife Refuge. The Sonny Bono Salton Sea National Wildlife Refuge is 40 miles north of the Mexican border at the southern end of the Salton Sea within the Sonoran Desert. The Refuge has two separate managed units, 18 miles apart. Each unit contains wetland habitats, farm fields, and tree rows. The land of the Salton Sea Refuge is flat, except for Rock Hill, a small, inactive volcano, located near Refuge Headquarters. Bordering the Refuge is the Salton Sea on the north and farmlands on the east, south, and west.

FIGURE 2-9
SALTON CITY AIR MONITORING STATION

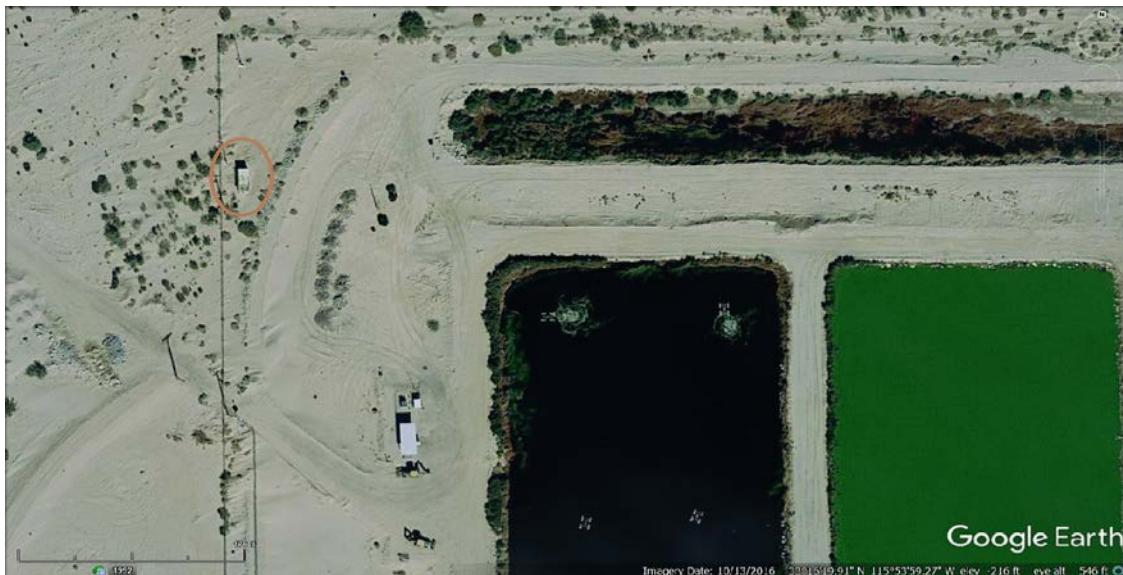


Fig 2-9: Depicts the Salton City air monitoring (circled) site operated by a private entity. View site photos at the California Air Resources Board monitoring website at https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17

FIGURE 2-10
SALTON CITY AIR MONITORING STATION
WEST



Fig 2-10: Photograph taken by the California Air Resources Board audit team in 2017. The photograph is taken from the west facing the probe.
https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17

FIGURE 2-11
NAVAL TEST BASE AIR MONITORING STATION



Fig 2-11: Depicts the Naval Test Base air monitoring (circled) site operated by a private entity. To view the site photos visit the California Air Resources Board monitoring website at https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13603&date=17

FIGURE 2-12
NAVAL TEST BASE AIR MONITORING STATION
WEST



Fig 2-12: Photograph taken by the California Air Resources Board audit team in 2017. The photograph is taken from the west facing the probe.
https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17

FIGURE 2-13
SONNY BONO AIR MONITORING STATION



Fig 2-13: Depicts the Sonny Bono air monitoring (circled) site operated by a private entity. To view the site photos visit the California Air Resources Board monitoring website at
https://www.arb.ca.gov/qaweb/sitephotos.php?site_no=13604&date=17

FIGURE 2-14
SONNY BONO SALTON SEA NATIONAL WILDLIFE REFUGE

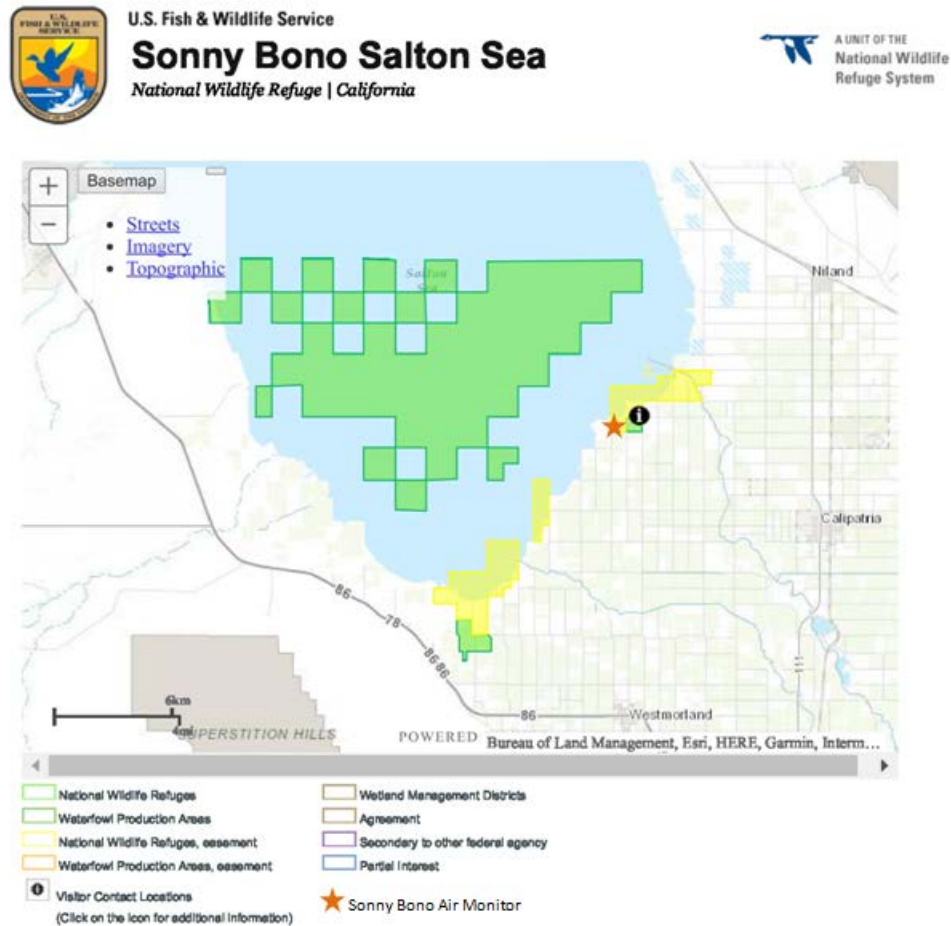


Fig 2-14: The Sonny Bono Wildlife Refuge has about 2,000 acres that are farmed and managed for wetlands. In 1998, the Refuge was renamed after Congressman Sonny Bono, who helped inform the U.S. Congress of the environmental issues facing the Salton Sea as well as acquiring funding for this Refuge to help it respond to avian disease outbreaks and other habitat challenges at the Salton Sea. Source: https://www.fws.gov/refuge/Sonny_Bono_Salton_Sea/about.html

TABLE 2-1
MONITORING SITES IN IMPERIAL COUNTY, RIVERSIDE COUNTY AND ARIZONA
AUGUST 19, 2016 AND AUGUST 21, 2016

Monitor Site Name	*Operator	Monitor Type	AQS ID	AQS PARAMETER CODE	ARB Site Number	Elevation (meters)	Day	24-hr PM ₁₀ (µg/m³) Avg	1-hr PM ₁₀ (µg/m³) Max	**Time of Max Reading	Max Wind Speed (mph)	**Time of Max Wind Speed
IMPERIAL COUNTY												
Brawley- Main Street #2	ICAPCD	BAM 1020	06-025- 0007	(81102)	13701	-15	19	156	995	17:00	-	-
							21	114	381	03:00	-	-
Calexico- Ethel Street	CARB	BAM 1020	06-025- 0005	(81102)	13698	3	19	115	985	17:00	10.4	17:00
							21	139	552	00:00	10.1	00:00
El Centro-9th Street	ICAPCD	BAM 1020	06-025- 1003	(81102)	13694	9	19	143	995	17:00	11.4	17:00
							21	170	750	00:00	19.3	07:00
Niland- English Road	ICAPCD	BAM 1020	06-025- 4004	(81102)	13997	-57	19	152	798	18:00	21	00:00
							21	76	141	00:00	12.1	00:00
Westmorland	ICAPCD	BAM 1020	06-025- 4003	(81102)	13697	-43	19	164	995	17:00	8.5	18:00
							21	118	364	03:00	10	00:00
RIVERSIDE COUNTY												
Palm Springs Fire Station	SCAQMD	TEOM	06-065- 5001	(81102)	33137	174	19	34	80	08:00	10	16:00
							21	75	252	23:00	4	00:00
Indio (Jackson St.)	SCAQMD	TEOM	06-065- 2002	(81102)	33157	1	19	54	178	01:00	10.8	21:00
							21	84	159	02:00	8.1	01:00
ARIZONA – YUMA												
Yuma Supersite	ADEQ	TEOM	04-027- 8011	(81102)	N/A	60	19	-	-	-	-	-
							21	-	-	-	-	-

*CARB = California Air Resources Board

*ICAPCD = Air Pollution Control District, Imperial County

*SCAQMD = South Coast Air Management Quality District

*ADEQ = Arizona Department of Environmental Quality

**Time represents the actual time/hour of the measurement in question according to the zone time (PST unless otherwise noted)

August 18, 2016 through August 21, 2016 were not scheduled sampling days

II.2 Climate

As mentioned above, Imperial County is part of the Colorado Desert, which is a subdivision of the larger Sonoran Desert (**Figure 2-15**) encompassing approximately 7 million acres (28,000 km²). The desert area encompasses Imperial County and includes parts of San Diego County, Riverside County, and a small part of San Bernardino County.

FIGURE 2-15
SONORAN DESERT REGION

The Sonoran Desert Region consists of the Sonoran Desert itself plus the surrounding biological communities, including the Sea of Cortez (Gulf of California) and its islands



Fig 2-15: Depicts the magnitude of the region known as the Sonoran Desert. Source: Arizona-Sonora Desert Museum at <http://desertmuseum.org/center/map.php>

The majority of the Colorado Desert lies at a relatively low elevation, below 1,000 feet (300 m), with the lowest point of the desert floor at 275 feet (84 m) below sea level at the Salton Sea. Although the highest peaks of the Peninsular Range reach elevations of nearly 10,000 feet (3,000 m), most of the region's mountains do not exceed 3,000 feet (910 m).

In the Colorado Desert (Imperial County), the geology is dominated by the transition of the tectonic plate boundary from rift to fault. The southernmost strands of the San Andreas Fault connect to the northern-most extensions of the East Pacific Rise. Consequently, the region is subject to earthquakes, and the crust is being stretched, resulting in a sinking of the terrain over time.

The Colorado Desert's climate distinguishes it from other deserts. The region experiences greater summer daytime temperatures than higher-elevation deserts and almost never experiences frost. In addition, the Colorado Desert experiences two rainy seasons per year (in the winter and late summer), especially toward the southern portion of the region which includes a portion of San Diego County. The Colorado Desert portion of San Diego County receives the least amount of precipitation. Borrego Springs, the largest population center within the San Diego desert region averages 5 inches of rain with a high evaporation rate. By contrast, the more northerly Mojave Desert usually has only winter rains.

The west coast Peninsular Ranges, or other west ranges, of Southern California–northern Baja California, block most eastern Pacific coastal air and rains, producing an arid climate. Other short or longer-term weather events can move in from the Gulf of California to the south, and are often active in the summer monsoons. These include remnants of Pacific hurricanes, storms from the southern tropical jet stream, and the northern Inter Tropical Convergence Zone (ITCZ).

The arid nature of the region is demonstrated when historic annual average precipitation levels in Imperial County average 2.64” (**Figure 2-16**). During the 12 month period prior to the August 9, 2016 event, Imperial County measured a total annual precipitation of 0.83 inches. Such arid conditions, as those preceding the event, result in soils that are particularly susceptible to particulate suspension by the elevated gusty winds.

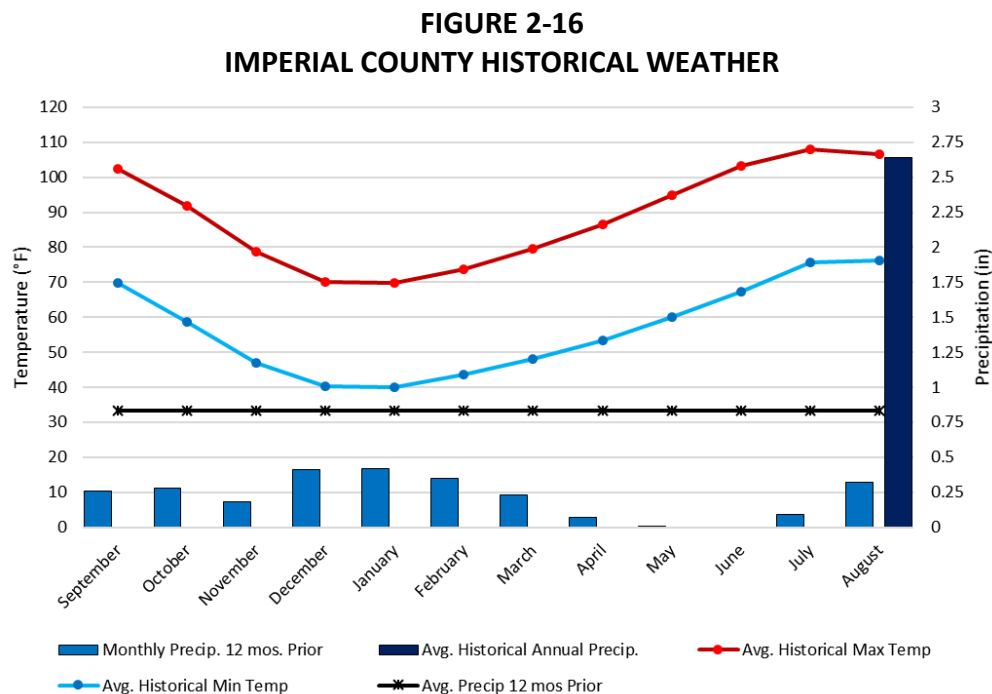


Fig 2-16: In the months prior to August 9, 2016, the region suffered abnormally low total precipitation of 0.83 inches. Average annual precipitation is 2.64 inches. Meteorological data courtesy of Western Regional Climate Center (WRCC) and Weather Underground <http://www.wrcc.dri.edu/cgi-bin/climain.pl?ca2713>

The NWS explains that the speed of any wind resulting from a weather system is directly proportional to the change in air pressure, called a pressure gradient, such that when the pressure gradient increases so does the speed of the wind.⁴ Because the pressure gradient is just the difference in pressure between high and low pressure areas, changes in weather patterns may recur seasonally.

Typically, high pressure brings clear skies and with no clouds there is more incoming shortwave solar radiation causing temperatures to rise. When surface winds become light, the cooling of the air produced directly under a high-pressure system can lead to a buildup of particulates in urban areas under an elongated region of relatively high atmospheric pressure or ridge causing widespread haze. Conversely, a trough is an elongated region of relatively low atmospheric pressure often associated with fronts. Troughs may be at the surface, or aloft under various conditions. Most troughs bring clouds, showers, and a wind shift, particularly following the passage of the trough.

While windblown dust events in Imperial County during the fall, winter, and spring are often due to strong winds associated with low-pressure systems and cold fronts, windblown dust events during the summer monsoon season are often due to wind flow aloft from the East or South-East. This phenomenon is known as the North American Monsoon (NAM)⁵. The NAM occurs when there is a shift in wind patterns during the summer, which occurs as Mexico and the southwest United States warm under intense solar heating reversing airflow from dry land areas to moist ocean areas. Consequently, the prevailing winds start to flow from moist ocean areas into dry land areas (**Figure 2-17**).

⁴ NWS JetStream – Origin of Wind <http://www.srh.noaa.gov/jetstream/synoptic/wind.html>

⁵ National Weather Service document “[North American Monsoon](#)” public domain material from the NWS Forecast Office Tucson, Arizona

FIGURE 2-17
WEATHER PATTERN OF THE NORTH AMERICAN MONSOON

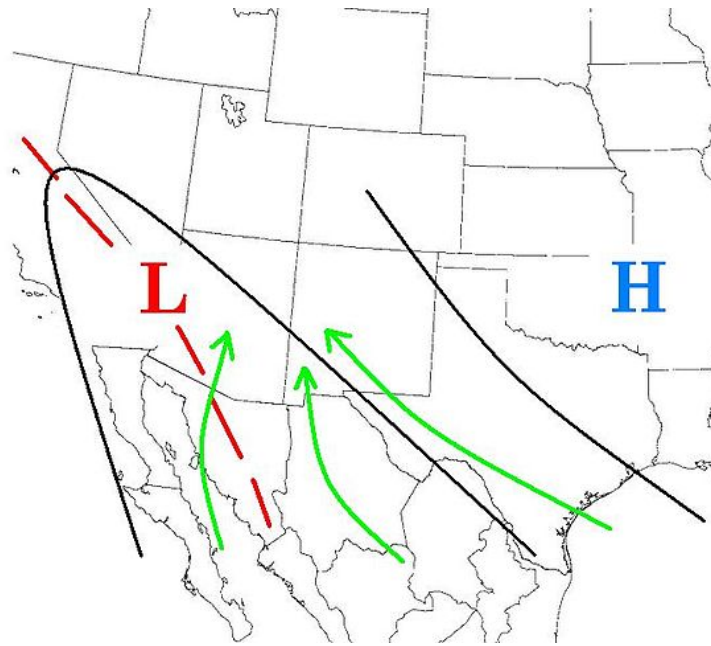


Fig 2-17: Weather pattern of the North American Monsoon. The North American monsoon, variously known as the Southwest monsoon, the Mexican monsoon, or the Arizona monsoon is a pronounced increase in rainfall from an extremely dry June to a rainy July over large areas of the southwestern United States and northwestern Mexico. Image courtesy of Wikipedia “North American Monsoon.”

The NAM circulation typically develops in late May or early June over southwest Mexico. By mid to late summer, thunderstorms increase over the “core” region of the southwest United States and northwest Mexico⁶. The transport of moisture into Mexico, Arizona and the southwestern United States can come quickly and sometimes dramatically, known as “bursts” and “breaks” which can unleash violent flash floods, thousands of lightning strikes, crop-damaging hail, and walls of damaging winds and blowing dust.⁷

The monsoon typically arrives in mid to late June over northwest Mexico and early July over the southwest United States. While the southern areas of Mexico experience a low level monsoon circulation, transported primarily from the Gulf of California and the eastern Pacific, an upper level monsoon (or subtropical) ridge develops over the southern High Plains and northern Mexico. Thus, by late June or early July the ridge shifts into the southern Plains or southern Rockies creating less resistance for the mid and upper level moisture streams to enter the United States. If the ridge is too close to a particular area, the sinking air, at its center suppresses

⁶ According to the NWS Tucson Arizona regional office report affected areas include the United States, Arizona, New Mexico, Sonora, Chihuahua, Sinaloa and Durango.

⁷ 2004: The North American Monsoon. Reports to the Nation on our Changing Planet. NOAA/National Weather Service. Available on line at: http://www.cpc.noaa.gov/products/outreach/Report-to-the-Nation-Monsoon_aug04.pdf

thunderstorms and can result in a significant monsoon “break”. However, if the ridge sets up in a few key locations, widespread and potentially severe thunderstorms can develop.

In Imperial County, isolated thunderstorms begin to develop, mainly during the hottest part of the day. The convective uplift of moist air over the hot desert landscape can produce thunderstorms, which in turn can generate gusty and highly variable winds. On occasion, a few of these thunderstorms are pushed by the winds into the lower deserts during the evening hours.

Thus, when high humid air is pushed up the Gulf of California, also known as a gulf surge the most common synoptic pattern is an easterly wave over central Mexico and an intensifying thermal low over the desert southwest. Although current studies include the relationship of gulf surges to tropical easterly and midlatitude westerly waves, additional study remains in order to understand why some gulf surges contain sufficient precipitation while others do not. Suffice to say that during the NAM season there are northward surges of relatively cool, moist maritime air from the eastern tropical Pacific into the southwestern United States via the Gulf of California (e.g. Hales 1972; Brenner 1974; Stensrud et al. 1997; Fuller and Stensrud 2000). These events are related to the amount of convective activity in northwestern Mexico and portions of the southwestern United States.⁸

FIGURE 2-18
CONCEPTUAL DIAGRAM OF GULF SURGE TRIGGER

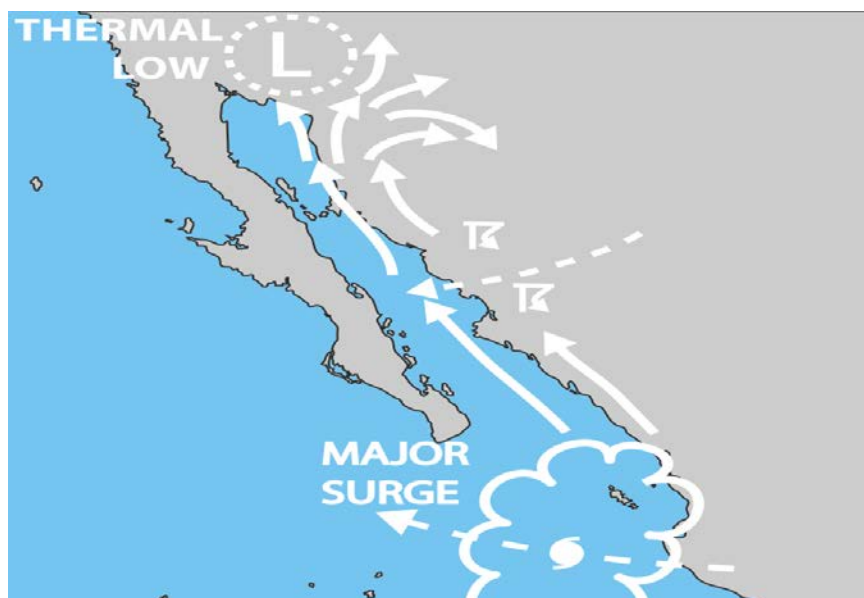


Fig 2-18: A conceptual diagram of how a tropical system can trigger a gulf surge. Source: Gulf of California moisture surge Wikipedia The Free Encyclopedia
https://en.wikipedia.org/wiki/Gulf_of_California_moisture_surge

⁸ Relationships Between Gulf of California Moisture Surges and Precipitation in the Southwestern United States, R.W. Higgins, W. Shi and C. Hain, Climate Prediction Center, NOAA/NWS/NCEP February 2004 (Journal of Climate – in Press)
<https://www.eol.ucar.edu/projects/name/documentation/hsh04.pdf>

II.3 Event Day Summary

The exceptional event for August 9, 2016, caused in part by the intrusion of monsoonal moisture that travelled northeast from Mexico and into the desert southwest, deviated from the typical monsoonal pattern typically associated with tropical storm remnant flow that affects Arizona and California. The August 9, 2016 event, anticipated by the NWS as primarily affecting Arizona and not Southern California, differed from a typical monsoonal pattern when a trough within the West created a dynamical forcing associated with a wave moving through the bottom of the trough.

As early as August 5, 2016, remnant moisture from the then dissipated Tropical Storm Earl, which migrated northward and westward from southern Mexico, merged with the newly formed east Pacific Tropical Depression Eleven-E forming Tropical Storm Javier. Once formed, Tropical Storm Javier tracked northwestward toward Mexico's Baja Peninsula, when a rather sharp southward plunge of the jet stream over the western United States created an alley allowing Tropical Storm Javier to reach landfall by Monday, August 8, 2016.

The remnant moisture existing in Mexico combined with the moisture from Tropical Storm Javier and the southward jet stream in the United States gave confidence to forecast discussions of damaging wind potentials mainly along south-central Arizona with less potential to southwest Arizona.⁹

Overall, while thunderstorm activity did occur, expectations of heavy rainfall along central Arizona and eastward, gave way to a very frustrating weather pattern to forecast. After all, preparations by the Phoenix NWS office included no less than 45 notices, such as Bulletins, Preliminary Storm Reports, Flood Advisories, Urgent Weather Messages and Special Weather Statements attesting to the gusty southerly winds, blowing dust and thunderstorm activity. According to the Phoenix NWS office, Area Forecast Discussion dated August 10, 2016 excessive amounts of monsoon moisture from Tropical Storm Javier did surge into south-central Arizona Tuesday afternoon, but not at the level that models had forecast for Phoenix to Tucson. Instead, excessive moisture showed up in southwest Arizona, such as in Yuma.¹⁰ Finally, while the San Diego NWS office did not expect any weather change to SoCal from Tropical Storm Javier, the issued Area Forecast Discussion of August 9, 2016 by the San Diego NWS office identified areas of blowing dust in the Coachella Valley, the San Diego deserts and points east. According to the San Diego NWS, the gusty south winds were driven by the synoptic-scale flow around the base of the low-pressure trough over the western United States.¹¹

On August 9, 2016, gusty southerly winds, associated with a Gulf Surge and a dynamical forcing associated with a wave moving through the bottom of a trough to the West, transported

⁹ Area Forecast Discussion, National Weather Service Phoenix AZ, 830 PM MST (730 PM PST) Sunday, August 7, 2016 and Article by the Puerto Vallarta Daily News, "Ghost of Earl could spawn Pacific Coast tropical storm", August 5, 2016.

¹⁰ Area Forecast Discussion, National Weather Service Phoenix AZ, 320 AM MST (240 AM PST) Wednesday, August 10, 2016.

¹¹ Area Forecast Discussion, National Weather Service San Diego CA, 928 PM PDT (828 PM PST) Tuesday, August 9, 2016.

sufficient windblown dust emissions from areas as far south as northern Mexico. These windblown dust emissions affected areas in Arizona, such as Yuma, and in California, such as Coachella Valley and Imperial County causing an exceedance at four of five air monitors in Imperial County. Although the Brawley monitor measured elevated concentrations, it fell short of an exceedance.

Figures 2-19 through 2-25 provide information regarding the meteorological conditions that allowed for the return of moisture into the desert southwest and how the southward jet stream from the west would keep thunderstorm activity mainly along south-central Arizona. The return of the monsoonal moisture allowed for southerly winds to blow across the natural open deserts, agricultural lands and populated centers in Baja California and northeastern Mexico. The highly anticipated halt by the southward plunging Jet Stream did not halt all the associated monsoonal activity within south-central Arizona. Moisture did reach southwestern Arizona and southeastern California causing an exceedance of the NAAQS in Imperial County.

FIGURE 2-19
PUERTO VALLARTA DAILY NEWS AUGUST 5, 2016



Fig 2-19: The Puerto Vallarta Daily News article discussing the potential formation of Tropical Storm Javier and how the jet stream to the west pushing southward could provide an alley allowing Tropical Storm Javier to hit the Baja Peninsula. In addition, the jet stream would keep any moisture surge to the east. A copy of the article is included in **Appendix A**. Source: <https://www.vallartadaily.com/ghost-earl-spawn-pacific-coast-tropical-storm/>

FIGURE 2-20

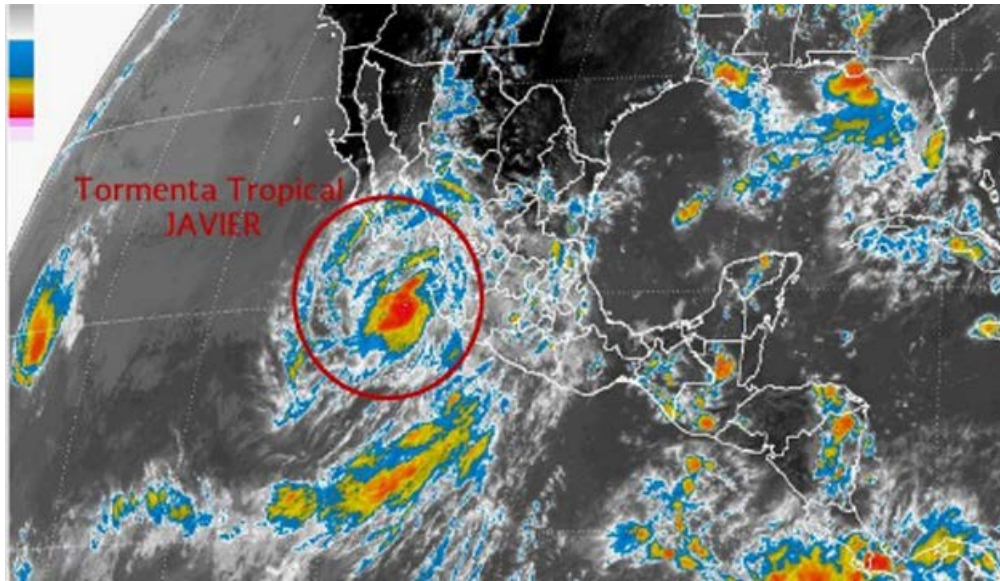
TROPICAL STORM JAVIER MOVING TOWARD BAJA CALIFORNIA AUGUST 7, 2016

Fig 2-20: The El Mundo newspaper article “Tropical Storm Javier is formed near the coasts of western Mexico” discussed the formation of Tropical Storm Javier. The article explained that once Tropical Storm Javier formed the Servicio Meteorológico Nacional (SMN), equivalent to the National Weather Service in the United States, anticipated its movement northward reaching Baja California Sur between August 9, 2016 and August 10, 2016. The damaging effects from the storm caused the SMN to urge populations within the path of the storm, La Paz to Santa Fe, in Baja California Sur, to commence civil preparedness activities. A copy of the article is included in **Appendix A**. Source: <http://elmundo.sv/se-forma-la-tormenta-tropical-javier-cerca-de-costas-del-oeste-de-mexico/>

FIGURE 2-21
INCREASING STORM CHANCES AUGUST 7, 2016

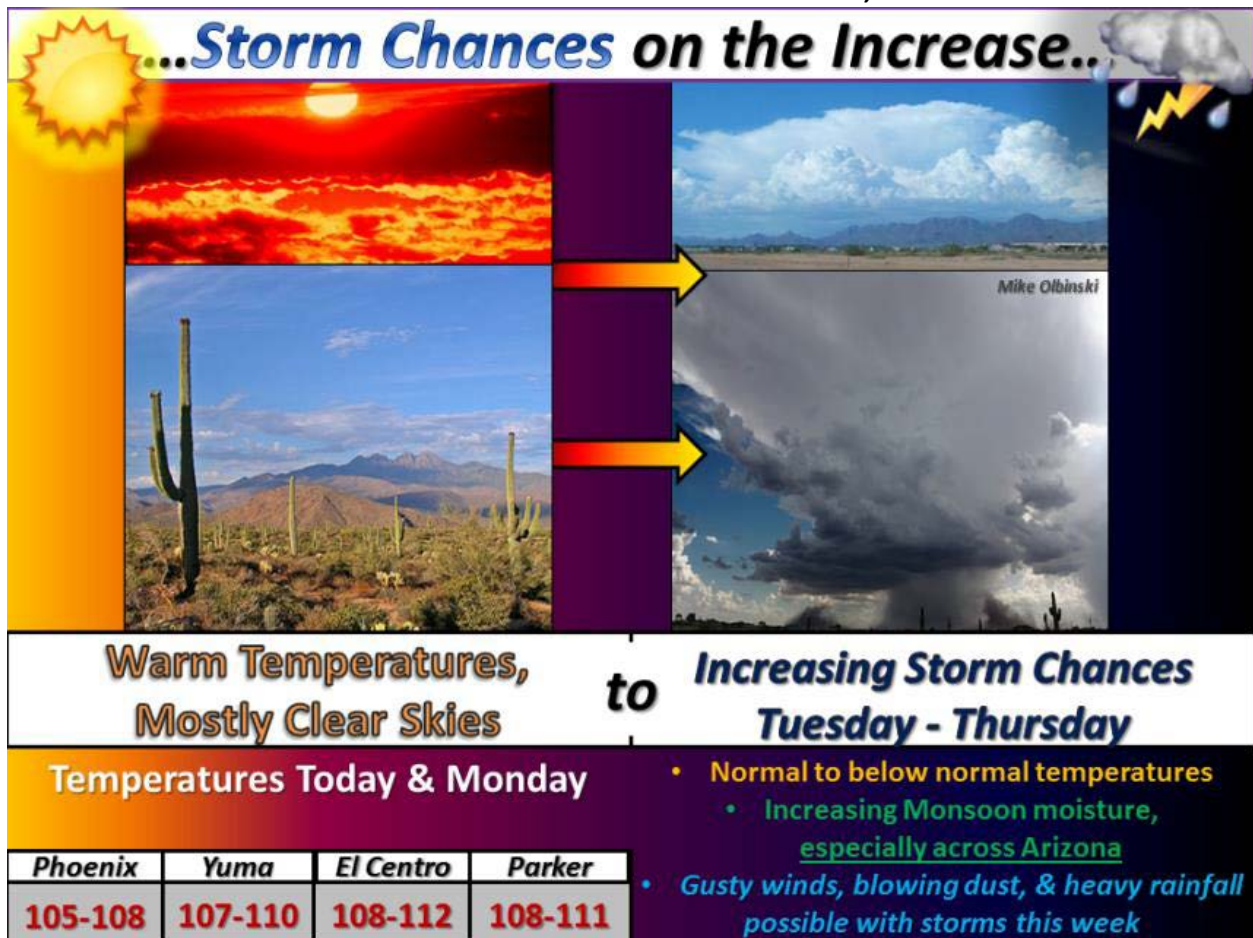


Fig 2-21: The Phoenix NWS office released a Weather Briefing August 7, 2016 for the week of August 8, 2016 identifying the return of Monsoon storms. The identified initial concerns were for strong thunderstorm winds and blowing dust transitioning to heavy rainfall through the work week. A copy of the Weather Briefing is included in **Appendix A**. Source: National Weather Service Phoenix, AZ Forecast Office Weather Briefing

FIGURE 2-22
SIGNIFICANT IMPACTS FROM JAVIER AUGUST 9, 2016

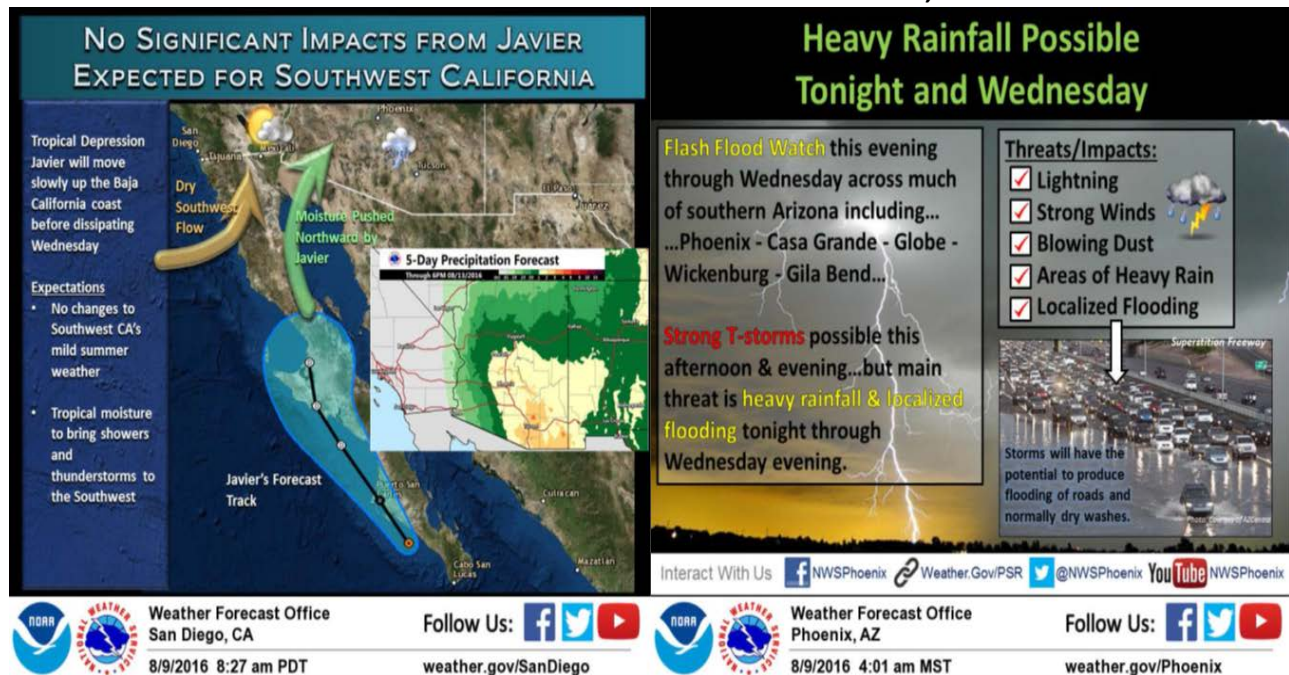


Fig 2-22: the NWS Weather Story images issued by the San Diego and Phoenix office for August 9, 2016 identifies the potential impacts from the expected intrusion of monsoonal air into the desert southwest. The San Diego NWS did not expect any significant impacts while the Phoenix office expected significant impacts. The 5-day precipitation forecast issued by the San Diego NWS office illustrates where the moisture levels would stop. Prior analysis by the both offices identified the southward jet stream as halting the moisture levels from reaching the west and primarily affecting south-central Arizona. Source: NWS San Diego and Phoenix Office Weather Story, August 9, 2016

FIGURE 2-23
MODIS CAPTURES CLOUDS AUGUST 9, 2016

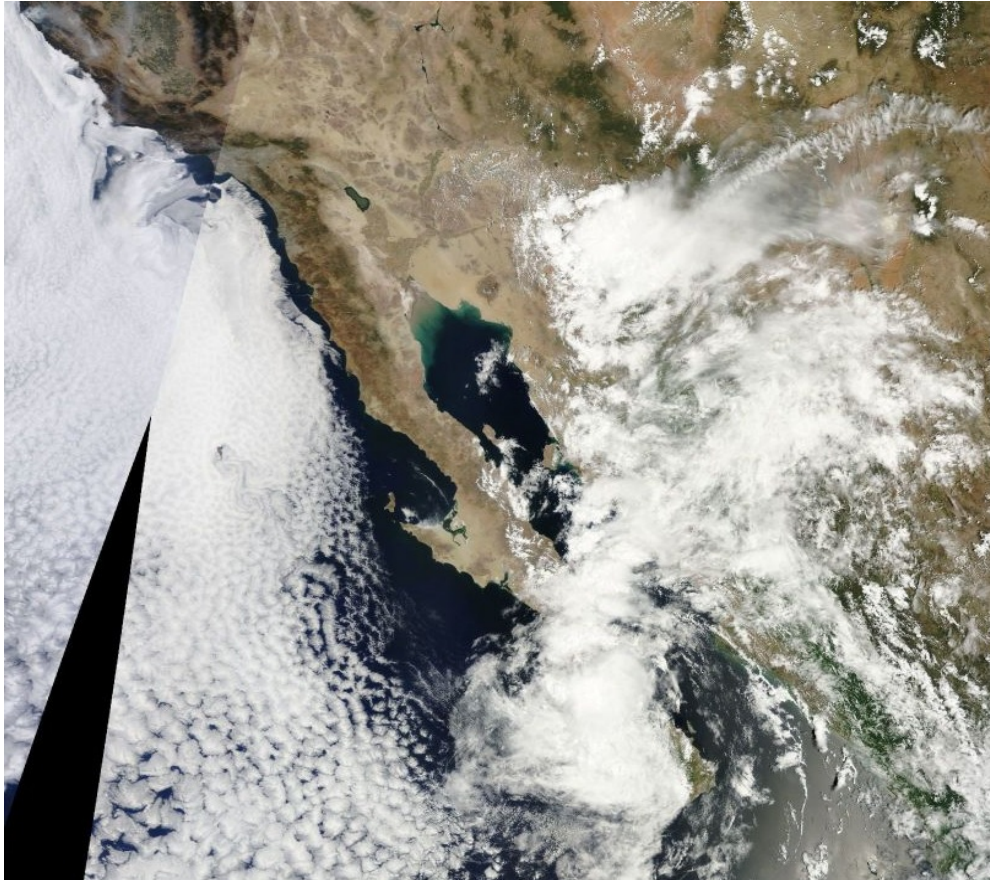


Fig 2-23: The image captured by the MODIS instrument onboard the Terra satellite at around 1030 PST on August 9, 2016 illustrates the clouds associated with the remnant moisture and Tropical Storm Javier. Prior analysis identified weather conditions conducive to the movement northward by Tropical Storm Javier as also contributing to the gusty southerly winds that affected the desert southwest within California. Source: AirNow Tech Navigator

FIGURE 2-24
NWS WEATHER AND HAZARDS DATA VIEWER AUGUST 9, 2016

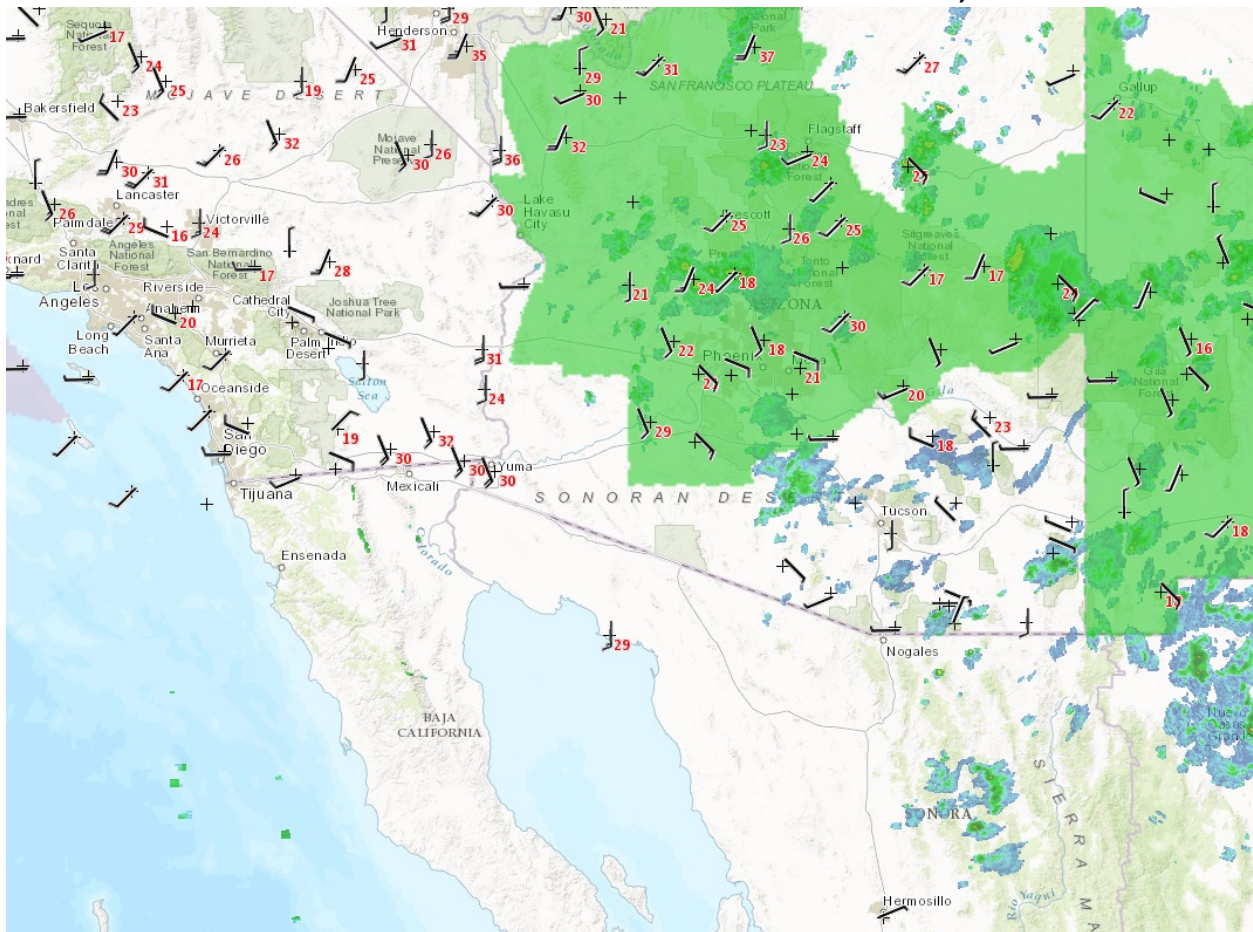


Fig 2-24: The Weather and Hazards generated image at 1408 PST, with the radar option activated, illustrates the wind barbs as southerly winds across southeastern California. The red numbers indicate the speed of the wind gusts. The 1408 PST hour falls within the measured hourly peak concentrations at the air monitors in Imperial County. Green color indicates areas under a Flash Flood Watch. Source: NWS Weather & Hazards Viewer

FIGURE 2-25
TROPICAL MOISTURE SURGE AUGUST 10, 2016

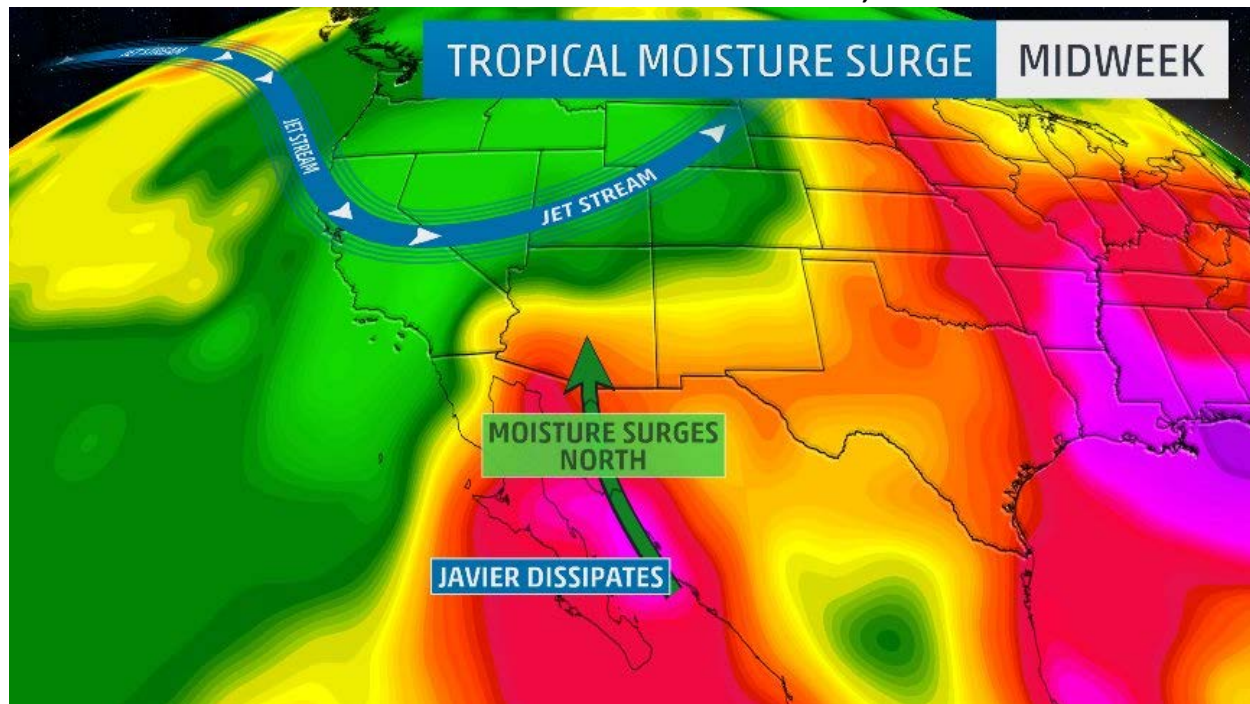


Fig 2-25: The Weather Channel released an article identifying the threats following the surge of tropical moisture from Ex-Javier. The article explains the remaining threat for the desert southwest specifically, Albuquerque, Flagstaff, Phoenix and Tucson. The discussion explained that moisture associated with Ex-Javier and moisture to its east was pulled north by a southward dip in the jet stream in the western United States. The Article summarized the implications of the continued surge for the next few days with heavy rainfall, flash flooding and dangerous lightning. A copy of the article is included in **Appendix A**. Source: AirNow Tech Navigator

As mentioned above the NWS began discussion the return of monsoonal moisture as early as August 5, 2016. Essentially, the remnant moisture existing in Mexico combined with the moisture from Tropical Storm Javier and the southward jet stream in the United States gave confidence to forecast discussions of damaging wind potentials mainly along south-central Arizona with less potential to southwest Arizona.

The Phoenix NWS office issued the earliest forecast discussion, August 8, 2016, attesting to the potential impact of convection across portions of south-central Arizona without any affect to SoCal. The discussion identified the impressive Tropical Storm Javier south of San Diego off the west coast along with the impending surge of moisture northward on Tuesday, August 9, 2016. The expectation was that the initial surge of humidity would provide an ideal balance between the moisture needed to initiate convection and the dry air needed to generate downbursts. In addition to this, the San Diego NWS office identified a large upper level trough along the West Coast, which would remain through Wednesday before moving inland. Accompanying the expected minor cooling would be gusty southwest to west winds within the mountains and below

the desert passes each afternoon and evening. While the Phoenix NWS office acknowledged the expected impact of what was described as an ample vorticity and jet-forced ascent associated with the persistent trough across the Pacific Northwest, the timing indicated that any affect from the trough would occur Wednesday, August 10, 2016.¹² This allowed for forecast discussions by the Phoenix NWS office to affirm that a north/south dry line described as wavering back and forth along the Colorado River through Wednesday would keep thunderstorm activity, in particular rainfall, focused on the south-central Arizona deserts and mountains generally along Prescott-Phoenix and Tucson.¹³ Therefore as discussed above, it was with no surprise that the NWS office in Phoenix kept a very close eye on activities and reported no less than 45 different notices, such as Bulletins, Preliminary Storm Reports, Flood Advisories, Urgent Weather Messages and Special Weather Statements attesting to the gusty southerly winds, blowing dust and thunderstorm activity. For this event, timing was everything.

The outcome of the timing of the event did not go quite as expected. While the San Diego NWS office did not expect any weather change to SoCal from Tropical Storm Javier, the August 9, 2016 released area forecast discussion indicated that gusty south winds over the lower deserts generated areas of blowing dust in the Coachella Valley, the San Diego deserts and points east. The discussion identified the winds as driven by a synoptic-scale flow around the base of the low-pressure trough over the western United States.

Finally, as previously discussed, the Phoenix NWS office frustrated by the outcome of the initial surge of moisture that entered the southwest deserts on Tuesday, August 9, 2016 did confirm excessive moisture within southwest Arizona, not previously forecasted, affecting areas such as Yuma. This would confirm that as the initial surge of moisture moved northward, with the Pacific west trough in place, and the increasing jet stream, meteorological conditions were conducive to gusty southerly winds along the desert southwest, with areas to the south and east of Imperial County transitioning to rain, by Wednesday, August 10, 2016. The window of dry, gusty winds while short lived was sufficient to transport windblown dust from natural open deserts to the south of Imperial County over agricultural lands and populated centers causing an exceedance at the air monitors in Imperial County, except for the Brawley monitor. As the jet stream increased allowing for cooler temperature in southern California, moisture moved further northeastward allowing for a transition to rainfall.

Locally, all airports, including the Yuma MCAS (KNYL) and Mexicali International Airport all measured elevated gusty winds during the mid-morning to afternoon hours of August 9, 2016. KNYL reported blowing dust between the hours of 0657 PST and 1657 PST while the Mexicali airport reported blowing dust between 1130 PST to 1648 PST August 9, 2016. **Figure 2-26** depicts the ramp-up analysis for August 9, 2016 providing a visual depiction of the meteorological conditions that existed when an initial surge of monsoonal air combined with the presence of a trough along the Pacific west and the increasing jet stream resulted in gust southerly winds within Imperial County. These gusty southerly winds transported windblown dust into Imperial County

¹² Area Forecast Discussion, National Weather Service Phoenix AZ, 333 AM MST (233 AM PST) Monday, August 8, 2016.

¹³ Area Forecast Discussion, National Weather Service Phoenix AZ, 330 AM MST (230 AM PST) Tuesday, August 9, 2016.

causing an exceedance at four out of five air monitors. The Brawley monitor measured elevated concentrations but failed to exceed the standard.

FIGURE 2-26
RAMP UP ANALYSIS AUGUST 9, 2016

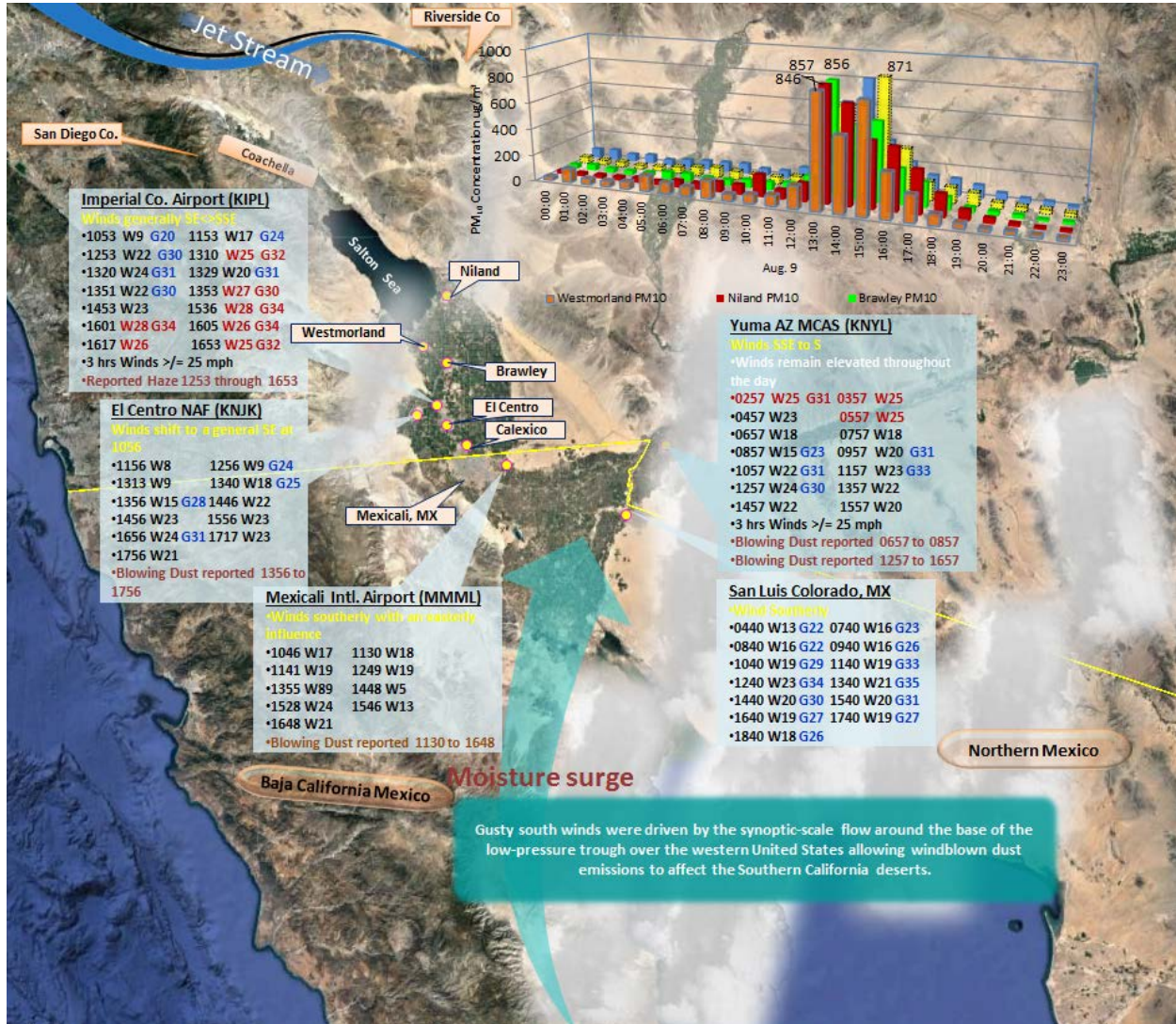


Fig 2-26: Gusty southerly winds resulting from a synoptic-scale flow around the base of the low-pressure trough over the western United States affected Imperial County on August 9, 2016. The meteorological conditions on August 9, 2016 included the initial moisture surge northward into the desert southwest from Mexico, the Pacific west trough and an increasing jet stream. These meteorological conditions allowed for gusty southerly winds to impact southeastern California, during the afternoon hours of August 9, 2016. As the Jet Stream continued to increase, meteorological conditions transitioned to rainfall east of Imperial County allowing for less suspended particulates. All times adjusted to PST. Google Earth base map

Table 2-2 contains a summary of maximum winds, peak wind gusts, and wind direction at monitors in Imperial County, eastern Riverside County, Yuma County, Arizona, and Mexicali. For detailed meteorological station, graphs see **Appendix B**.

TABLE 2-2
WIND SPEEDS ON AUGUST 9, 2016

Station Monitor	Maximum Wind Speed (WS) (mph)	Wind Direction during Max WS (degrees)	*Time of Max Wind Speed	24 hr Maximum Wind Gust (WG) (mph)	Time of Max WG	PM ₁₀ correlated to time of Max Wind Speed				
						Brly	CX	EC	NInd	Wstmid
Airport Meteorological Data IMPERIAL COUNTY										
Imperial Airport (KIPL)	28	140	15:36	34	15:36	590	370	871	495	809
Naval Air Facility (KNJK)	24	130	16:56	31	16:56	267	222	366	467	334
Calexico (Ethel St)	14.8	124	14:00	-	-	552	815	652	737	556
El Centro (9th Street)	14.1	130	15:00	-	-	590	370	871	495	809
Niland (English Rd)	18.2	147	16:00	-	-	267	222	366	467	334
Westmorland	15.3	137	15:00	-	-	590	370	871	495	809
RIVERSIDE COUNTY										
Blythe Airport (KBLH)	22	190	5:52	31	12:52	52	59	47	30	121
Palm Springs Airport (KPSP)	15	320	17:53	24	17:53	188	138	141	323	197
Jacqueline Cochran Regional Airport (KTRM) - Thermal	15	130	15:52	23	15:52	590	370	871	495	809
ARIZONA - YUMA										
Yuma MCAS (KNYL)	25	150	2:57	33	11:57	32	58	37	27	44
MEXICALI - MEXICO										
Mexicali Int. Airport (MXL)	24.2	130	16:28	-	-	267	222	366	467	334

*All time referenced throughout this document is in Pacific Standard Time (PST) unless otherwise noted

The National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory HYSPLIT back trajectory model,¹⁴ depicted in **Figures 2-27 and 2-28** depict the general path of airflow 6 hours prior to 1400 PST and 12 hours prior to 1800 PST on August 9, 2016. As mentioned above, it is the timing associated with the event that is critical to the exceedances measured in Imperial County. The ending hour at 1400 PST is coincident with the measured hourly peak concentration at the Calexico monitor. The ending hour of 1800 PST is coincident with the last measured concentrations at or above 100 µg/m³ and reduced wind speeds.

¹⁴ The Hybrid Single Particle Lagrangian Integrated Trajectory Model (**HYSPLIT**) is a computer model that is a complete system for computing simple air parcel trajectories to complex dispersion and deposition simulations. It is currently used to compute air parcel trajectories and dispersion or deposition of atmospheric pollutants. One popular use of HYSPLIT is to establish whether high levels of air pollution at one location are caused by transport of air contaminants from another location. HYSPLIT's back trajectories, combined with satellite images (for example, from NASA's [MODIS](#) satellites), can provide insight into whether high air pollution levels are caused by local air pollution sources or whether an air pollution problem was blown in on the wind. The initial development was a result of a joint effort between NOAA and Australia's Bureau of Meteorology. Source: NOAA/Air Resources Laboratory, 2011.

Both HYSPLIT models indicate long enduring surface level airflow at the 10 and 100-meter levels. It is interesting to note that the six hours prior to the measured peak concentration at the Calexico monitor the airflow at all three levels where not variable. That is all three levels indicate a direct northward path without deviation, centered toward each monitors. Contrast that with the 12 hours prior to the last measured concentration at or above $100 \mu\text{g}/\text{m}^3$. The direct tightening of the airflow at all three levels varied a bit favoring a slight easterly flow. Still both trajectories indicate an affect from the south, over natural open deserts, farmland and populated centers. All five air monitors in Imperial County measured elevated hourly concentrations primarily between the hours of 1200 PST and 1800 PST however only the Brawley monitor did not exceed the standard. Data used in the HYSPLIT model has a horizontal resolution of 12 km and is integrated every three hours. Thus, the HYSPLIT model may differ from local observed surface wind speeds and directions.

FIGURE 2-27
HYSPLIT MODEL ALL STATIONS ENDING 1400 PST

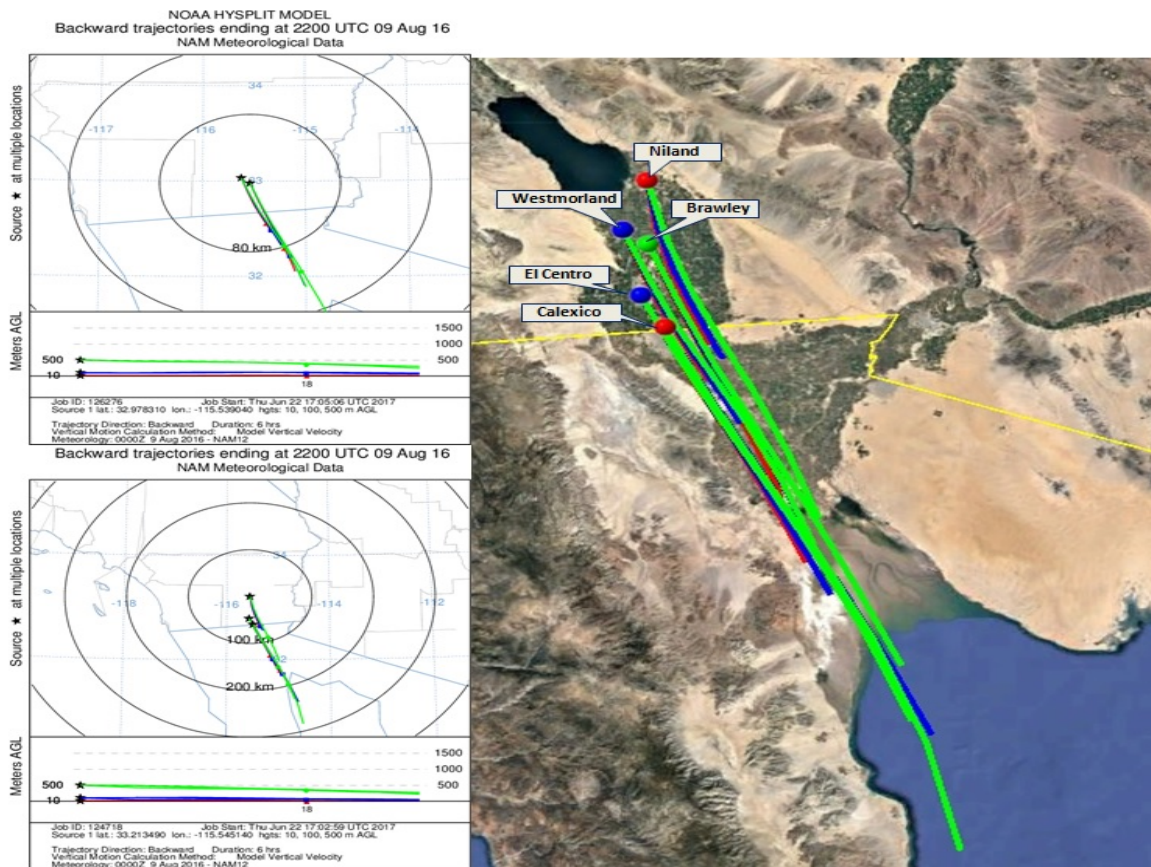


Fig 2-27: 6-hour back-trajectory ending at all stations at 1400 PST August 9, 2016 illustrates airflow over natural open desert areas, populated areas and farmland in Mexico and the United States. Red trajectory indicates airflow at 10 meters AGL (above ground level); blue indicates airflow at 100 m; green indicates airflow at 500m. Yellow line indicates the international border. Aqua lines denote county boundaries. Dynamically

generated through NOAA's Air Resources Laboratory HYSPLIT model. Base map from Google Earth

FIGURE 2-28
HYSPLIT MODEL ALL STATIONS ENDING 1800 PST

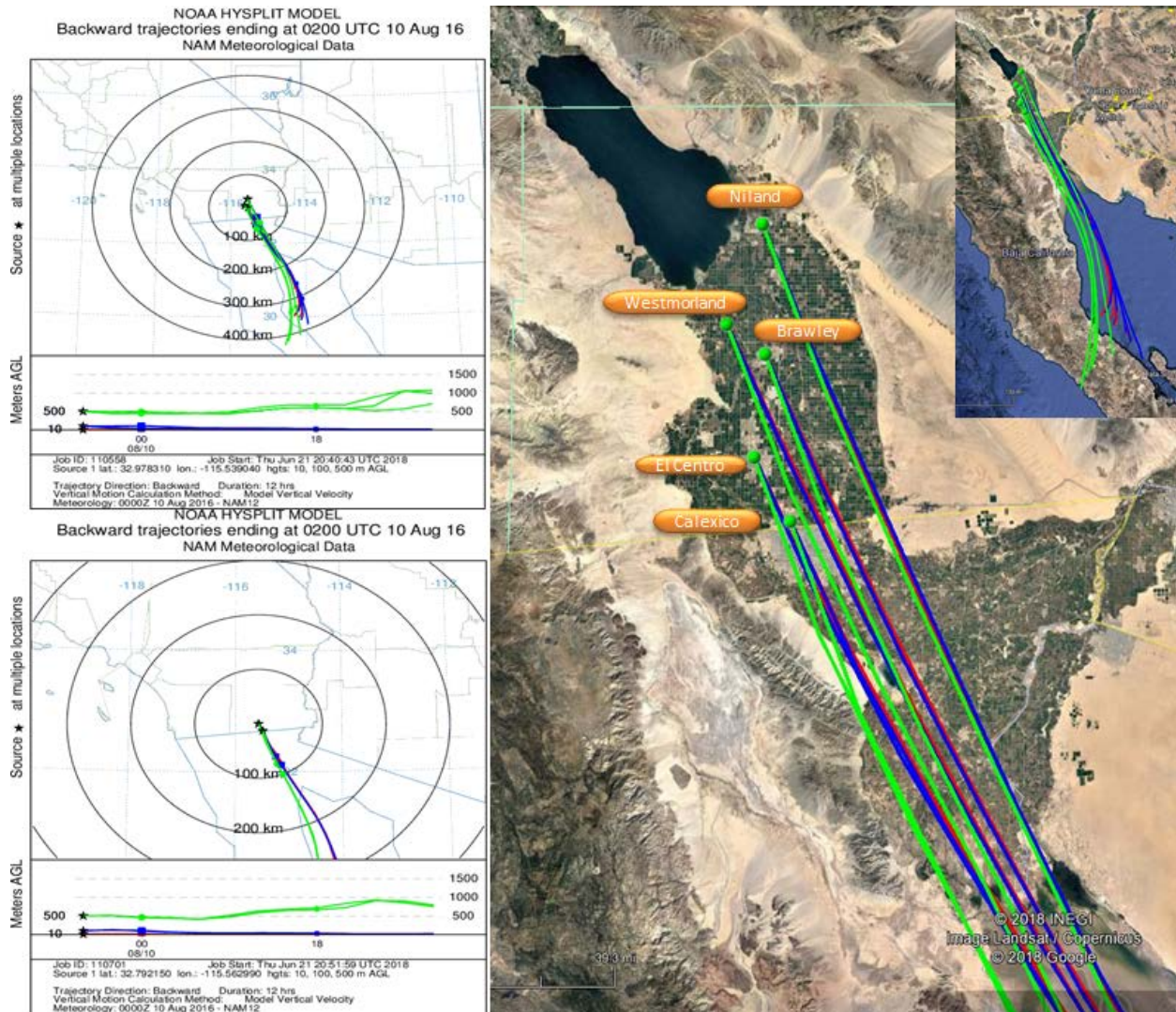


Fig 2-28: 12-hour back-trajectory ending at all stations at 1800 PST on August 9, 2016 illustrates that air flowed over natural open desert areas, populated areas and farmland in Mexico and the United States. Red trajectory indicates airflow at 10 meters AGL (above ground level); blue indicates airflow at 100 m; green indicates airflow at 500m. Yellow line indicates the international border. Aqua lines denote county boundaries. Dynamically generated through NOAA's Air Resources Laboratory HYSPLIT model. Base map from Google Earth

Figures 2-29 and 2-30 illustrate the elevated wind speeds and elevated levels of hourly PM₁₀ concentrations measured in Riverside, Imperial and Yuma Counties for three days, August 8, 2016 through August 10, 2016. Elevated dust emissions transported into Imperial County affected air monitors during a very specific period of time when dry gusty southerly winds, created by the

combination of a moisture surge, a fairly slow moving trough in the West and the southward bound Jet Stream produced a synoptic-scale flow around the base of the low-pressure trough. The Brawley, Calexico, El Centro, and Westmorland monitors measured the highest elevated concentrations between 1200 PST and 1800 PST on August 9, 2016 coincident with the measured wind speeds and gusts above 25mph.

The resulting entrained dust and accompanying high winds from the system qualify this event as a “high wind dust event”.¹⁵ High wind dust events are considered natural events where the windblown dust is either from solely a natural source or from areas where anthropogenic sources of windblown dust are controlled with Best Available Control Measures (BACM). The following sections provide evidence that the August 9, 2016 high wind event qualifies as a natural event and that BACM was overwhelmed by the suddenness and intensity of the meteorological event.

FIGURE 2-29
72-HOUR WIND SPEEDS AT REGIONAL AIRFIELDS

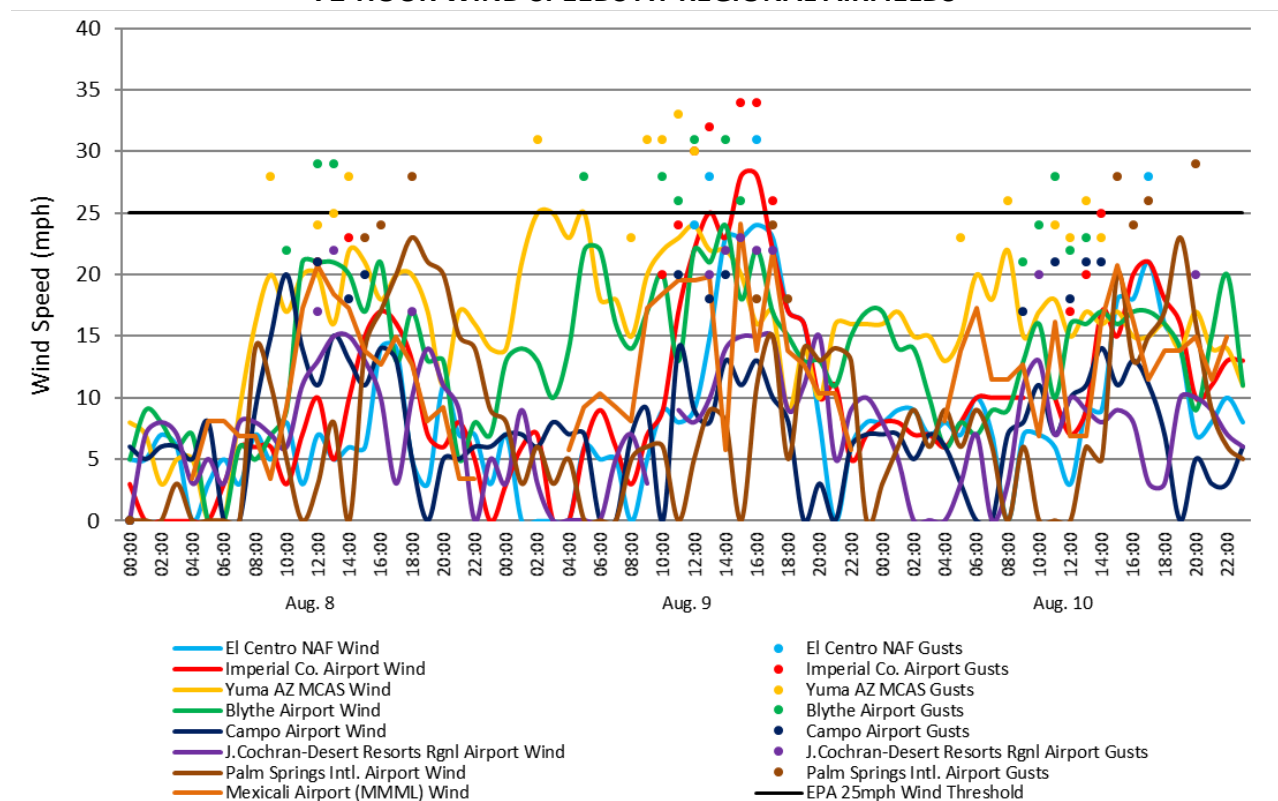


Fig 2-29: Is the graphical representation of the 72-hour measured winds speeds and gusts at regional airports in California and Arizona. The graph illustrates the significant number of hours where measured wind speeds and wind gusts were above 25 mph. The graph helps to substantiate the regional nature of the event. Wind Data from the NCEI’s QCLCD system

¹⁵ Title 40 Code of Federal Regulations part 50: §50.1(p) High wind dust event is an event that includes the high-speed wind and the dust that the wind entrains and transports to a monitoring site.

FIGURE 2-30
72-HOUR PM₁₀ CONCENTRATIONS AT VARIOUS SITES

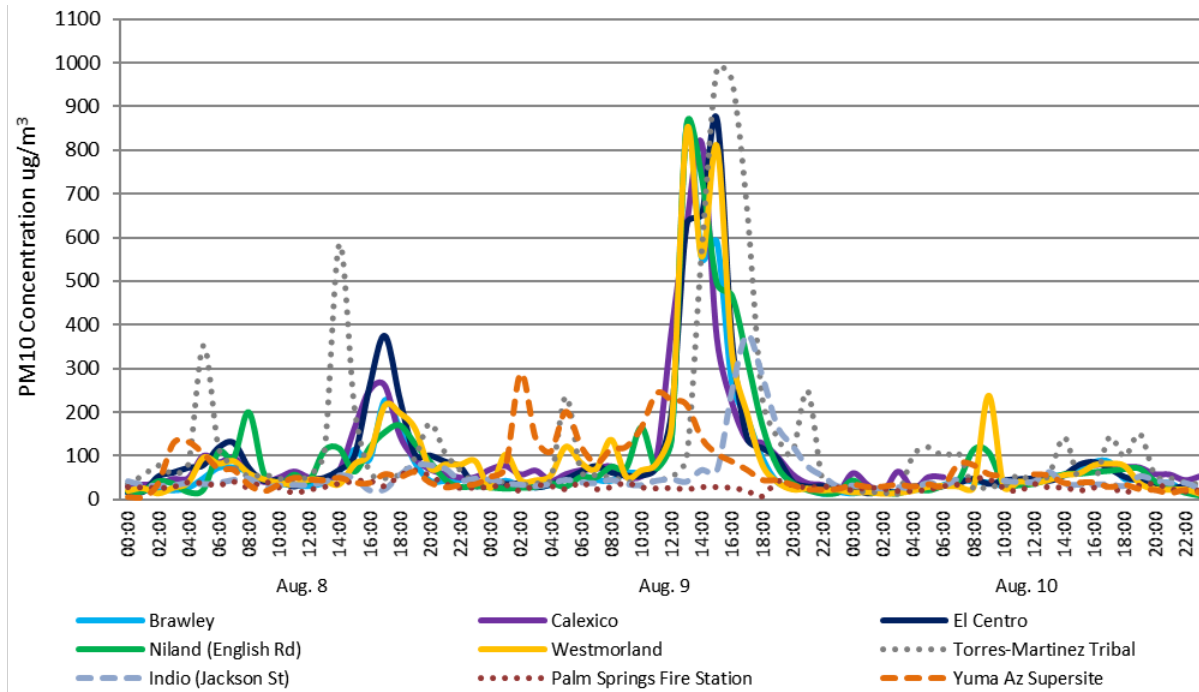


Fig 2-30: Is the graphical representation of the 72-hour relative PM₁₀ concentrations at various sites in California and Arizona. The elevated PM₁₀ concentrations at all sites on August 9, 2016 help demonstrate the regional effect of the weather system and accompanying winds. Air quality data from the EPA's AQS data bank

III Historical Concentrations

III.1 Analysis

While naturally occurring high wind events may recur seasonally and at times frequently and qualify for exclusion under the EER, historical comparisons of the particulate concentrations and associated winds provide insight into the frequency of events within an identified area. The following time series plots illustrate that PM₁₀ concentrations measured at the Calexico, El Centro, Niland, and Westmorland monitors on August 9, 2016, were compared to non-event and event days demonstrating the variability over several years and seasons. The analysis, also, provides supporting evidence that there exists a clear causal relationship between the August 9, 2016 high wind event and the exceedance measured at the Calexico, El Centro, Niland, and Westmorland monitors.

Figures 3-1 through 3-8 show the time series of available FRM and BAM 24-hr PM₁₀ concentrations at the Calexico, El Centro, Niland, and Westmorland stations for the period of January 1, 2010 through August 9, 2016. Note that prior to 2013, the BAM data was not considered FEM and was not reported into AQS.¹⁶ In order to properly establish the variability of the event as it occurred on August 9, 2016, 24-hour averaged PM₁₀ concentrations between January 1, 2010 and August 9, 2016 were compiled and plotted as a time series. All figures illustrate that the exceedance, which occurred on August 9, 2016 were outside the normal historical concentrations when compared to event and non-event days. Air quality data for all graphs was obtained through the EPA's AQS data bank.

¹⁶ Pollutant concentration data contained in EPA's Air Quality System (AQS) are required to be reported in units corrected to standard temperature and pressure (25 C, 760 mm Hg). Because the PM₁₀ concentrations prior to 2013 were not reported into the AQS database all BAM (FEM) data prior to 2013 within this report are expressed as micrograms per cubic meter (mg/m³) at local temperature and pressure (LTP) as opposed to standard temperature and pressure (STP, 760 torr and 25 C). The difference in concentration measurements between standard conditions and local conditions is insignificant and does not alter or cause any significant changes in conclusions to comparisons of PM₁₀ concentrations to PM₁₀ concentrations with in this demonstration.

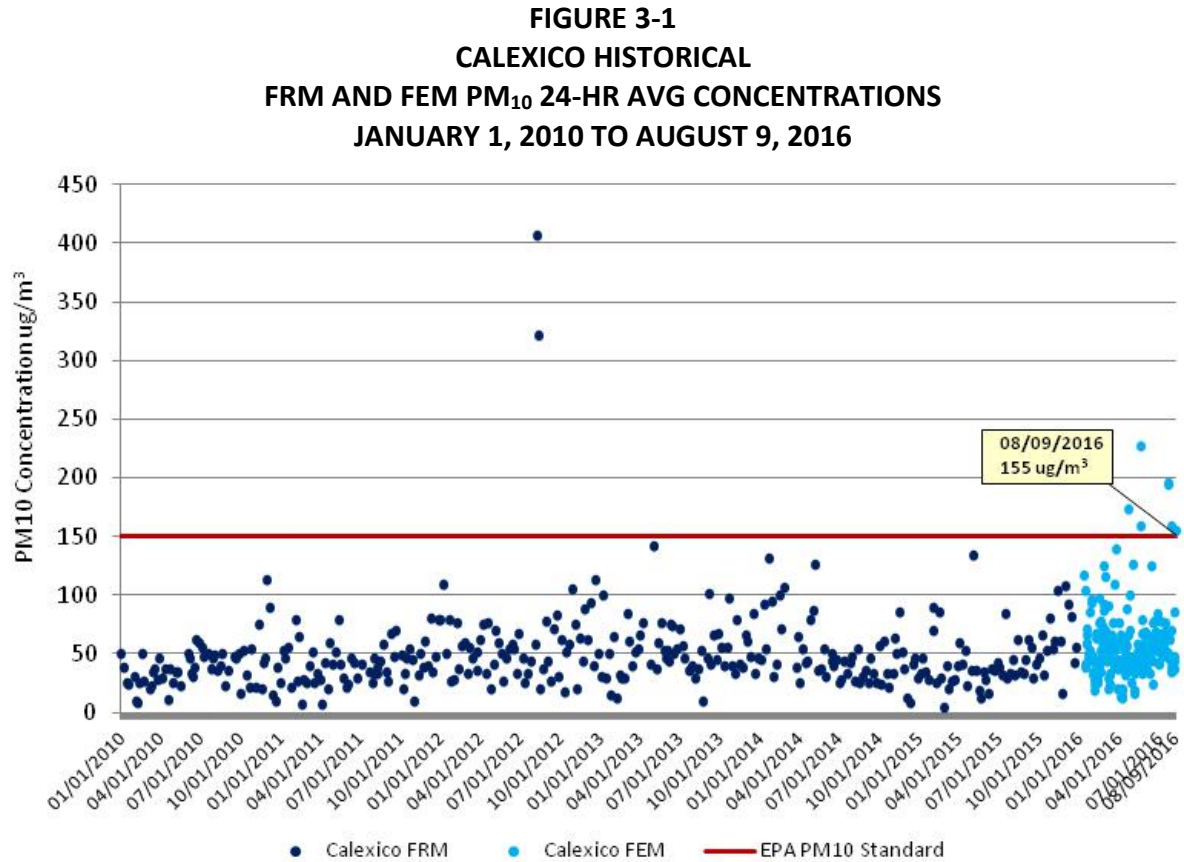


Fig 3-1: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentration of 155 $\mu\text{g}/\text{m}^3$ on August 9, 2016 by the Callexico monitor was outside the normal historical measurements. The far vast number of samples fall way below the exceedance threshold

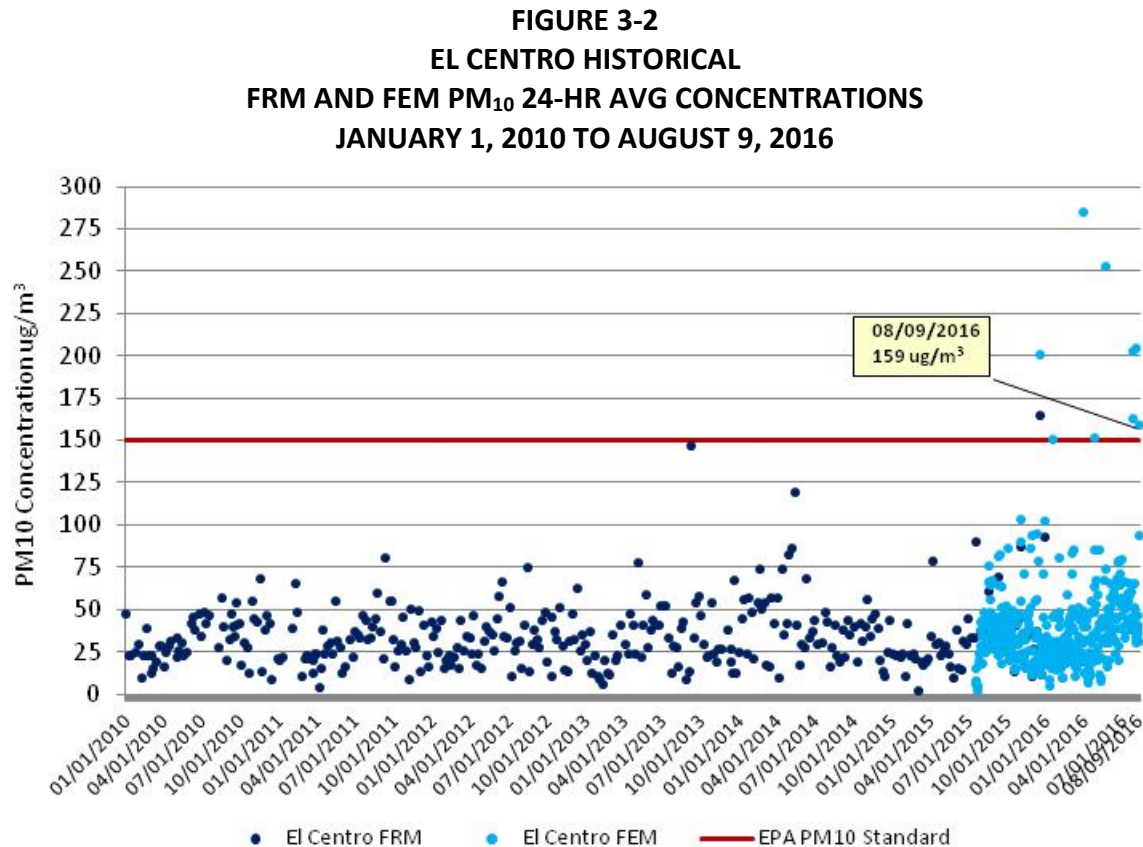


Fig 3-2: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentration of 159 $\mu\text{g}/\text{m}^3$ on August 9, 2016 by the El Centro monitor was outside the normal historical measurements. The far vast number of samples fall way below the exceedance threshold

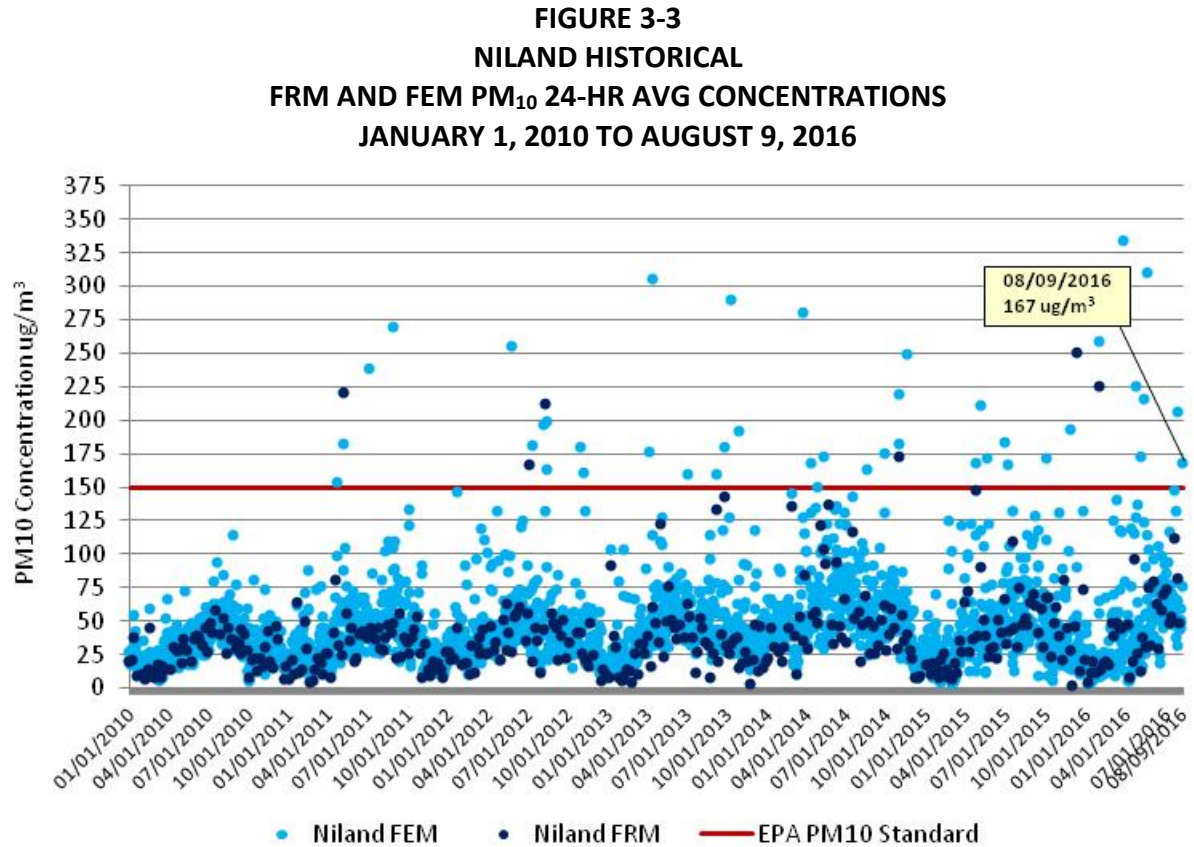


Fig 3-3: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentrations of 167 $\mu\text{g}/\text{m}^3$ on August 9, 2016 by the Niland monitor was outside the normal historical measurements. The far vast number of samples fall way below the exceedance threshold

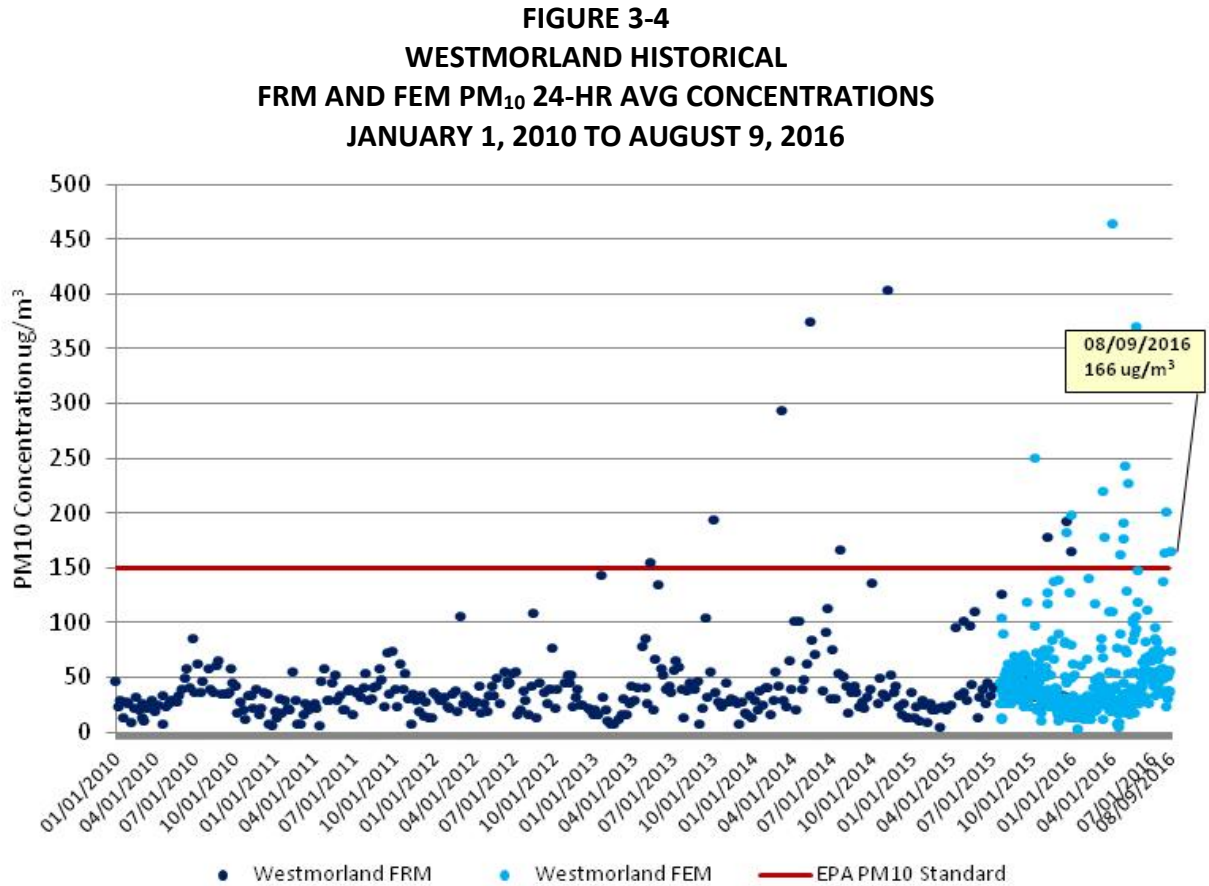
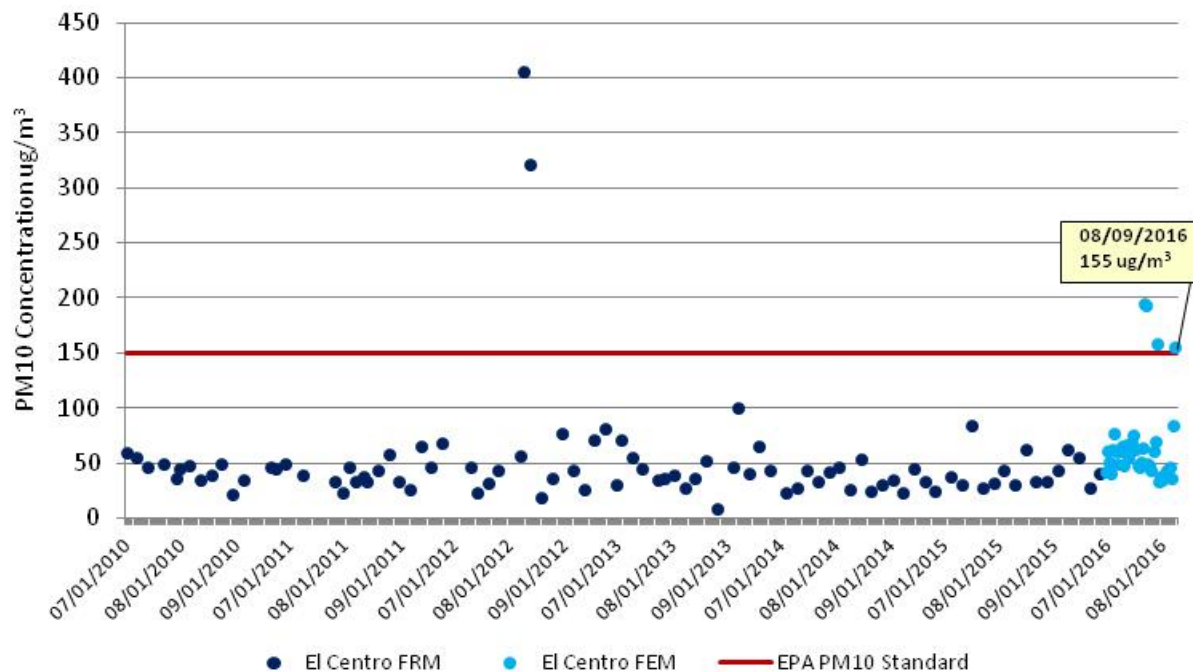


Fig. 3-4: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentrations of 166 $\mu\text{g}/\text{m}^3$ on August 9, 2016 by the Westmorland monitor was outside the normal historical measurements. The far vast number of samples fall way below the exceedance threshold

The time series, **Figures 3-1 through 3-4** for Calexico, El Centro, Niland, and Westmorland included 2,413 sampling days (January 1, 2010 through August 9, 2016). During this period the Calexico station (**Figure 3-1**) measured 569 credible samples (FEM sampling commenced in January 2016), measured by either FRM or FEM monitors between January 1, 2010 and August 9, 2016.

Overall, the time series illustrates that of the 569 credible samples measured during there was a total of nine exceedance days, which is a 1.6% occurrence rate. El Centro (**Figure 3-2**) measured 746 credible samples measured by either FRM or FEM monitors during this period (FEM sampling commenced in July 2015) during which the station measured seven exceedance days. This translates into 0.9% of all samples. Niland (**Figure 3-3**) measured 2,793 credible samples measured by either FRM or FEM monitors during this period while the station measured 45 exceedance days. This translates into 1.6% of all samples. Westmorland (**Figure 3-4**) measured 748 credible samples measured by either FRM or FEM monitors during this period (FEM sampling began in July 2015) and measured 23 exceedance days. This equates to 3.1% of all samples. Clearly, exceedances by any of the monitoring stations over a historical period is a rare event.

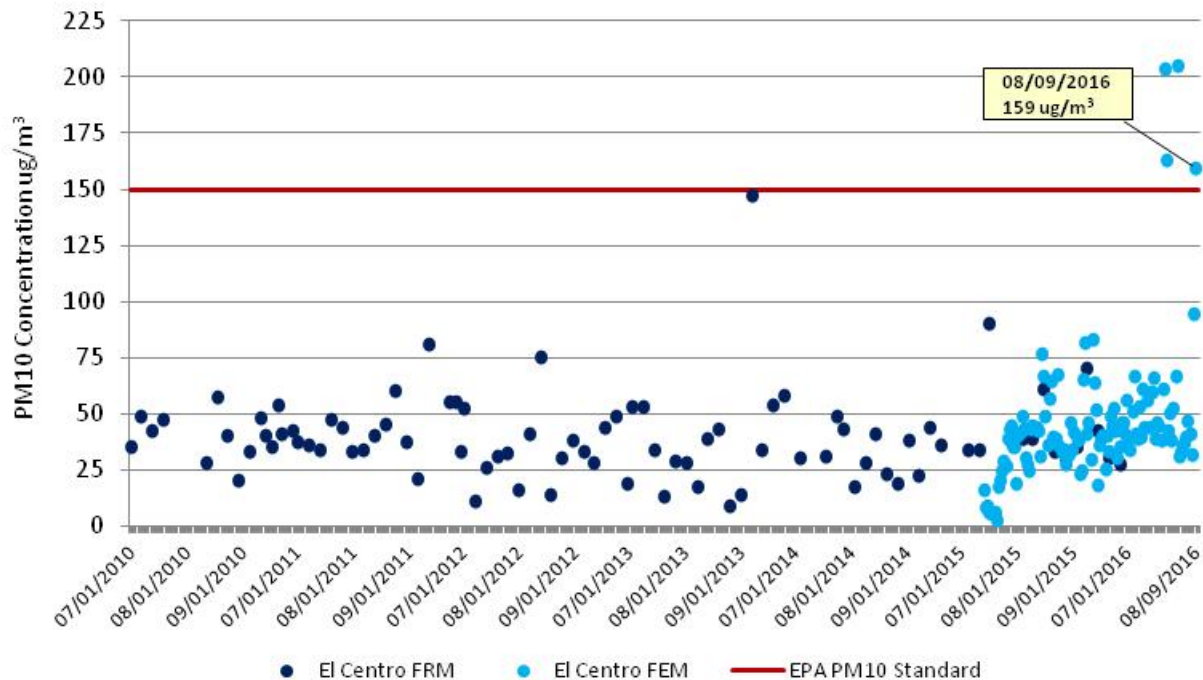
FIGURE 3-5
CALEXICO SEASONAL COMPARISON
PM₁₀ 24-HR AVG CONCENTRATIONS
***JULY 1, 2010 THROUGH AUGUST 9, 2016**



*July 1, 2010 through September 30, 2015 and July 1, 2016 through August 9, 2016

Fig 3-5: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentration of 155 $\mu\text{g}/\text{m}^3$ on August 9, 2016 by the Calexico monitor was outside the normal historical measurements. The far vast number of samples fall way below the exceedance threshold

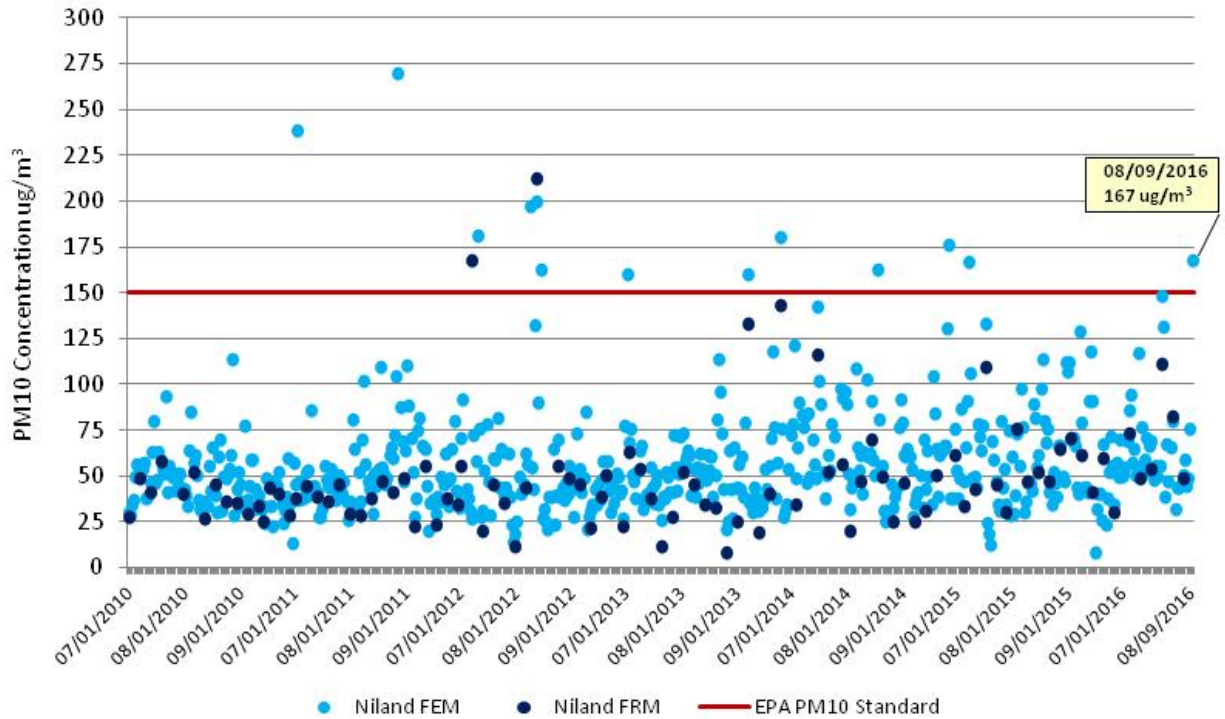
FIGURE 3-6
EL CENTRO SEASONAL COMPARISON
PM₁₀ 24-HR AVG CONCENTRATIONS
***JULY 1, 2010 THROUGH AUGUST 9, 2016**



*July 1, 2010 through September 30, 2015 and July 1, 2016 through August 9, 2016

Fig 3-6: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentration of 159 $\mu\text{g}/\text{m}^3$ on August 9, 2016 on by the El Centro monitor was outside the normal historical measurements. The far vast number of samples fall way below the exceedance threshold

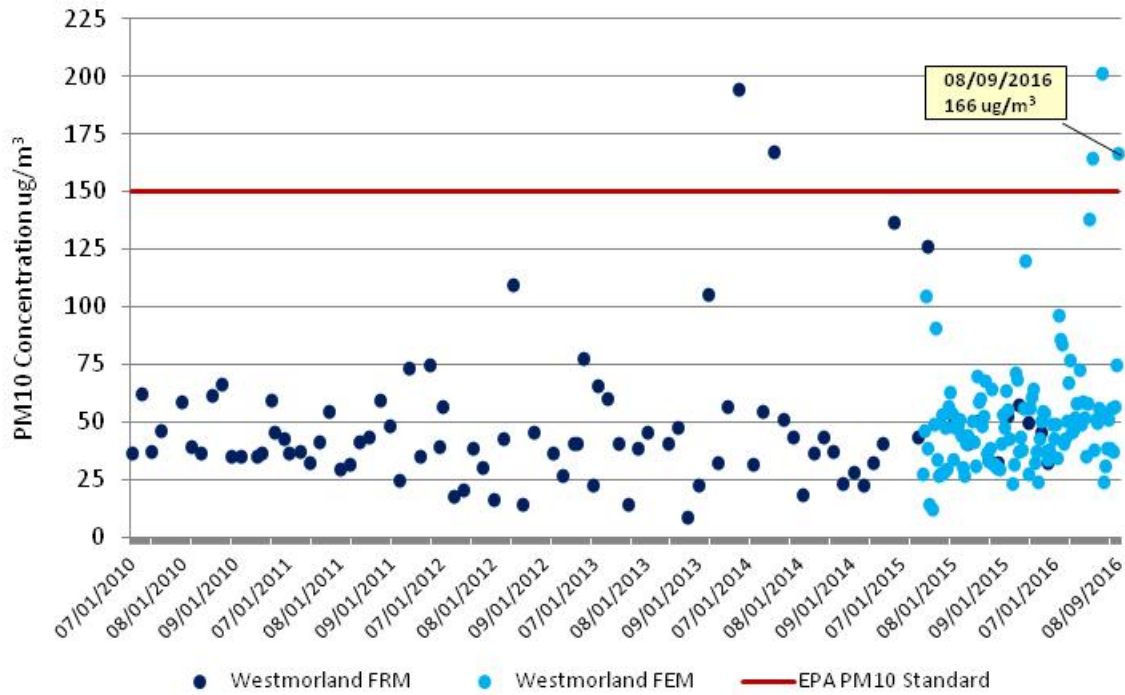
FIGURE 3-7
NILAND SEASONAL COMPARISON
PM₁₀ 24-HR AVG CONCENTRATIONS
***JULY 1, 2010 THROUGH AUGUST 9, 2016**



*July 1, 2010 through September 30, 2015 and July 1, 2016 through August 9, 2016

Fig 3-7: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentrations of 167 $\mu\text{g}/\text{m}^3$ on August 9, 2016 by the Niland monitor was outside the normal historical measurements. The far vast number of samples fall way below the exceedance threshold

FIGURE 3-8
WESTMORLAND SEASONAL COMPARISON
PM₁₀ 24-HR AVG CONCENTRATIONS
***JULY 1, 2010 THROUGH AUGUST 9, 2016**



*July 1, 2010 through September 30, 2015 and July 1, 2016 through August 9, 2016

Fig 3-8: A comparison of PM₁₀ historical concentrations demonstrates that the measured concentrations of 166 µg/m³ on August 9, 2016 by the Westmorland monitor were outside the normal historical measurements. The far vast number of samples fall way below the exceedance threshold

Figures 3-5 through 3-8 display the seasonal fluctuations over 592 sampling days at the Calexico, El Centro, Niland, and Westmorland stations for months July through September of years 2010 through 2016 (2016 ending August 9). The seasonal sampling period for Calexico (**Figure 3-5**) contains 244 combined FRM and FEM samples. Of these, six exceedances occurred during the third quarter which translates into 2.6% of all samples. The seasonal sampling period for El Centro (**Figure 3-6**)¹⁷ contains 207 credible samples and only four exceedance days. This translates into 1.9% of all samples. The seasonal sampling period for Niland (English Rd) station (**Figure 3-7**) contains 684 credible samples and 15 exceedance days, or 2.2% of all samples. The seasonal sampling period for Westmorland station (**Figure 3-8**)¹⁸ contains 207 credible samples and five exceedance days, or 2.4% of all samples.

¹⁷ FEM sampling at the El Centro site began July 2015 therefore January is the only seasonal first-quarter data available.

¹⁸ FEM sampling at the Westmorland site began July 2015 therefore January is the only seasonal first-quarter data available.

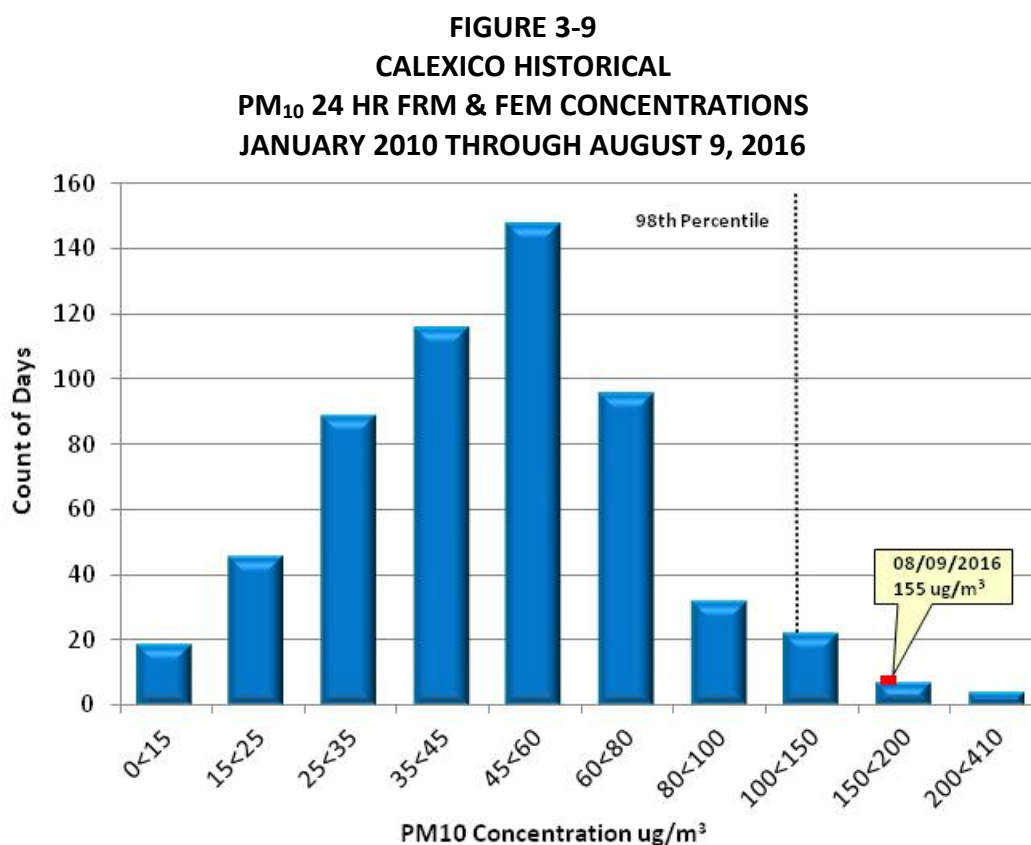


Fig 3-9: The 24-hr average PM₁₀ concentration at the Calexico monitoring site demonstrates that the concentration of 155 $\mu\text{g}/\text{m}^3$ on August 9, 2016 was in excess of the 98th percentile

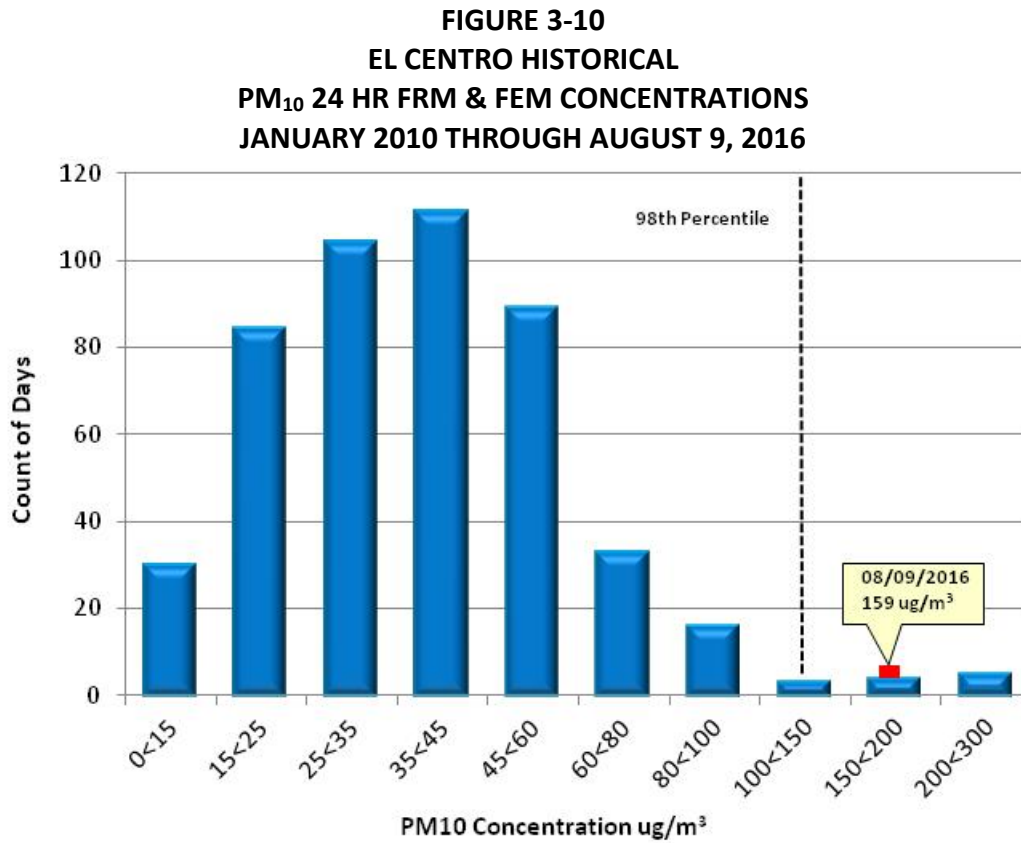


Fig 3-10: The 24-hr average PM₁₀ concentration at the Calexico monitoring site demonstrates that the concentration of 159 µg/m³ on August 9, 2016 was in excess of the 99th percentile

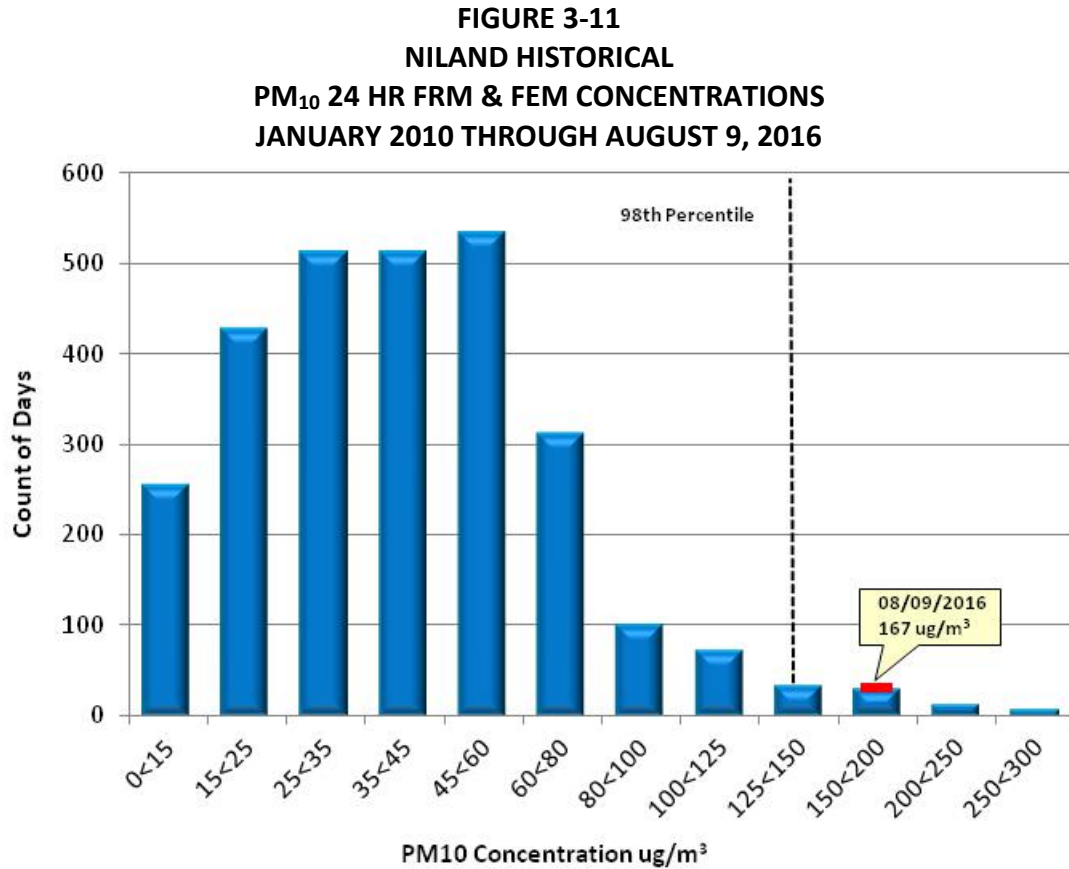


Fig 3-11: The 24-hr average PM₁₀ concentration at the Westmorland monitoring site demonstrates that the concentration of 167 $\mu\text{g}/\text{m}^3$ on August 9, 2016 fell on the 98th percentile

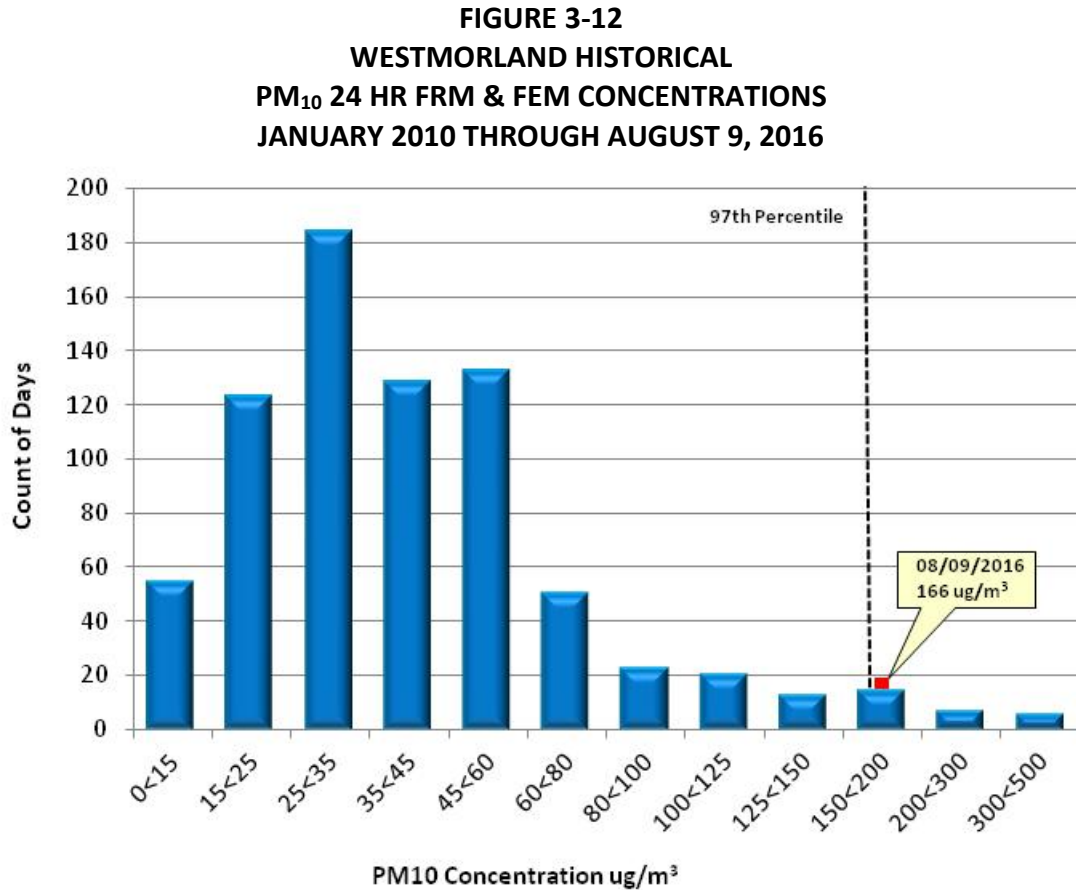


Fig 3-12: The 24-hr average PM₁₀ concentration at the Westmorland monitoring site demonstrates that the concentration of 166 µg/m³ on August 9, 2016 fell on the 98th percentile.

For the combined FRM and FEM data sets the annual historical and the seasonal historical PM₁₀ concentrations of 155 µg/m³, 159 µg/m³, 167 µg/m³, 166 µg/m³ for Calexico, El Centro, Niland, and Westmorland, respectively, are all above the 97th percentile ranking, while the concentration at Calexico, El Centro, and Niland was in excess of the 98th percentile. Looking at the annual time series concentrations, the seasonal time series concentrations, and the percentile rankings for both the historical and seasonal patterns, the August 9, 2016 measured exceedances are clearly outside the normal concentration levels when comparing to non-event days and event days.

III.2 Summary

The information provided, above, by the time series plots, seasonal time series plots, and the percentile rankings illustrate that the PM₁₀ concentration observed on August 9, 2016 occurs infrequently. When comparing the measured PM₁₀ levels on August 9, 2016 and following USEPA EER guidance, this demonstration provides supporting evidence that the measured exceedances measured at the Calexico, El Centro, Niland, and Westmorland monitoring sites were outside the normal historical and seasonal historical concentration levels.

The historical concentration analysis provided here supports the determination that the August 9, 2016 natural event affected the concentrations levels at the Calexico, El Centro, Niland, and Westmorland monitors causing an exceedance. The concentration analysis further supports that the natural event affected air quality in such a way that there exists a clear causal relationship between the measured exceedances on August 9, 2016 and the natural event, qualifying the natural event as an Exceptional Event.

IV Not Reasonably Controllable or Preventable

According to the October 3, 2016 promulgated revision to the Exceptional Event (EE) rule under 40 CFR §50.14(b)(8) air agencies must address the “not reasonably controllable or preventable” (nRCP) criterion as two prongs. In order to properly address the nRCP criterion the ICAPCD must not only identify the natural and anthropogenic sources of emissions causing and contributing to the monitored exceedance but must identify the relevant State Implementation Plan (SIP) measures and/or other enforceable control measures in place for the identified sources. An effective analysis of the nRCP must include the implementation status of the control measures in order to properly consider the measures as enforceable. USEPA considers control measures to be enforceable if approved into the SIP within 5 years of an EE demonstration submittal. The identified control measures must address those specific sources that are identified as causing or contributing to a monitored exceedance.

The final EE rule revision explains that an event is considered not reasonably controllable if reasonable measures to control the impact of the event on air quality were applied at the time of the event. Similarly, an event is considered not reasonably preventable if reasonable measures to prevent the event were applied at the time of the event. However, for “high wind events” when PM₁₀ concentrations are due to dust raised by high winds from desert areas whose sources are controlled with Best Available Control Measures (BACM) then the event is a “natural event” where human activity plays little or no direct causal role and thus is considered not preventable.

This section begins by providing background information on all SIP and other enforceable control measures in force during the EE for August 9, 2016. In addition, this August 9, 2016 demonstration provides technical and non-technical evidence that strong and gusty southerly winds blew across the deserts of northern Mexico and into Imperial County suspending particulate matter affecting the Calexico, El Centro, Niland, and Westmorland monitors on August 9, 2016. This section identifies all natural and anthropogenic sources and provides regulatory evidence of the enforceability of the control measures in place during the August 9, 2016 EE.

IV.1 Background

Inhalable particulate matter (PM₁₀) contributes to effects that are harmful to human health and the environment, including premature mortality, aggravation of respiratory and cardiovascular disease, decreased lung function, visibility impairment, and damage to vegetation and ecosystems. Upon enactment of the 1990 Clean Air Act (CAA) amendments, Imperial County was classified as moderate nonattainment for the PM₁₀ NAAQS under CAA sections 107(d)(4)(B) and 188(a). By November 15, 1991, such areas were required to develop and submit State Implementation Plan (SIP) revisions providing for, among other things, implementation of reasonably available control measures (RACM).

August 9, 2016 Exceptional Event, Imperial County

Partly to address the RACM requirement, ICAPCD adopted local Regulation VIII rules to control PM₁₀ from sources of fugitive dust on October 10, 1994, and revised them on November 25, 1996. USEPA did not act on these versions of the rules with respect to the federally enforceable SIP.

On August 11, 2004, USEPA reclassified Imperial County as a serious nonattainment area for PM₁₀. As a result, CAA section 189(b)(1)(B) required all BACM to be implemented in the area within four years of the effective date of the reclassification, i.e., by September 10, 2008.

On November 8, 2005, partly to address the BACM requirement, ICAPCD revised the Regulation VIII rules to strengthen fugitive dust requirements. On July 8, 2010, USEPA finalized a limited approval of the 2005 version of Regulation VIII, finding that the seven Regulation VIII rules largely fulfilled the relevant CAA requirements. Simultaneously, USEPA also finalized a limited disapproval of several of the rules, identifying specific deficiencies that needed to be addressed to fully demonstrate compliance with CAA requirements regarding BACM and enforceability.

In September 2010, ICAPCD and the California Department of Parks and Recreation (DPR) filed petitions with the Ninth Circuit Federal Court of Appeals for review of USEPA's limited disapproval of the rules. After hearing oral argument on February 15, 2012, the Ninth Circuit directed the parties to consider mediation before rendering a decision on the litigation. On July 27, 2012, ICAPCD, DPR and USEPA reached agreement on a resolution to the dispute which included a set of specific revisions to Regulation VIII. These revisions are reflected in the version of Regulation VIII adopted by ICAPCD on October 16, 2012 and approved by USEPA April 22, 2013. Since 2006 ICAPCD had implemented regulatory measures to control emissions from fugitive dust sources and open burning in Imperial County.

**FIGURE 4-1
REGULATION VIII GRAPHIC TIMELINE DEVELOPMENT**

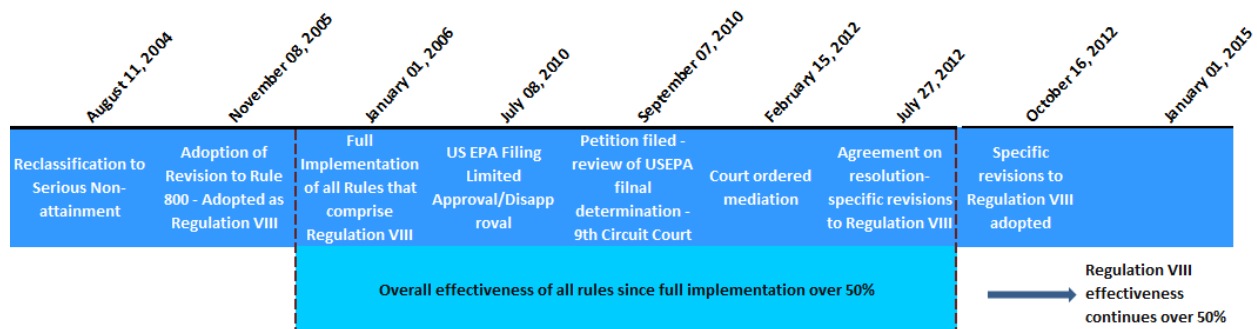


Fig 4-1: Regulation VIII Graphic Timeline

IV.1.a Control Measures

Below is a brief summary of Regulation VIII, which is comprised of seven fugitive dust rules. **Appendix D** contains a complete set of the Regulation VIII rules.

ICAPCD's Regulation VIII consists of seven interrelated rules designed to limit emissions of PM₁₀ from anthropogenic fugitive dust sources in Imperial County.

Rule 800, General Requirements for Control of Fine Particulate Matter, provides definitions, a compliance schedule, exemptions and other requirements generally applicable to all seven rules. It requires the United States Bureau of Land Management (BLM), United States Border Patrol (BP) and DPR to submit dust control plans (DCP) to mitigate fugitive dust from areas and/or activities under their control. Appendices A and B within Rule 800 describe methods for determining compliance with opacity and surface stabilization requirements in Rules 801 through 806.

Rule 801, Construction and Earthmoving Activities, establishes a 20% opacity limit and control requirements for construction and earthmoving activities. Affected sources must submit a DCP and comply with other portions of Regulation VIII regarding bulk materials, carry-out and track-out, and paved and unpaved roads. The rule exempts single family homes and waives the 20% opacity limit in winds over 25 mph under certain conditions.

Rule 802, Bulk Materials, establishes a 20% opacity limit and other requirements to control dust from bulk material handling, storage, transport and hauling.

Rule 803, Carry-Out and Track-Out, establishes requirements to prevent and clean-up mud and dirt transported onto paved roads from unpaved roads and areas.

Rule 804, Open Areas, establishes a 20% opacity limit and requires land owners to prevent vehicular trespass and stabilize disturbed soil on open areas larger than 0.5 acres in urban areas, and larger than three acres in rural areas. Agricultural operations are exempted.

Rule 805, Paved and Unpaved Roads, establishes a 20% opacity limit and control requirements for unpaved haul and access roads, canal roads and traffic areas that meet certain size or traffic thresholds. It also prohibits construction of new unpaved roads in certain circumstances. Single-family residences and agricultural operations are exempted.

Rule 806, Conservation Management Practices, requires agricultural operation sites greater than 40 acres to implement at least one conservation management practice (CMP) for each of several activities that often generates dust at agricultural operations. In addition, agricultural operation sites must prepare a CMP plan describing how they comply with Rule 806, and must make the CMP plan available to the ICAPCD upon request.

IV.1.b Additional Measures

Imperial County Natural Events Action Plan (NEAP)

On August 2005, the ICAPCD adopted a NEAP for the Imperial County, as was required under the former USEPA Natural Events Policy, to address PM₁₀ events by:

- Protecting public health;
- Educating the public about high wind events;
- Mitigating health impacts on the community during future events; and
- Identifying and implementing BACM measures for anthropogenic sources of windblown dust.

Smoke Management Plan (SMP) Summary

There are 35 Air Pollution Control Districts or Air Quality Management Districts in California which are required to implement a district-wide smoke management program. The regulatory basis for California's Smoke Management Program, codified under Title 17 of the California Code of Regulations is the "Smoke Management Guidelines for Agricultural and Prescribed Burning" (Guidelines). California's 1987 Guidelines were revised to improve interagency coordination, avoid smoke episodes, and provide continued public safety while providing adequate opportunity for necessary open burning. The revisions to the 1987 Guidelines were approved March 14, 2001. All air districts, with the exception of the San Joaquin Valley Air Pollution Control District (SJAPCD) were required to update their existing rules and Smoke Management Plans to conform to the most recent update to the Guidelines.

Section 80150 of Title 17 specifies the special requirements for open burning in agricultural operations, the growing of crops and the raising of fowl or animals. This section specifically requires the ICAPCD to have rules and regulations that require permits that contain requirements that minimize smoke impacts from agricultural burning.

On a daily basis, the ICAPCD reviews surface meteorological reports from various airport agencies, the NWS, State fire agencies and CARB to help determine whether the day is a burn day. Using a four quadrant map of Imperial County allowed burns are allocated in such a manner as to assure minimal to no smoke impacts safeguarding the public health. Finally, all permit holders are required to notice and advise members of the public of a potential burn. This noticing requirement is known as the Good Neighbor Policy. On August 9, 2016, the ICAPCD declared a Marginal Green Waste only Burn day (**Appendix A**). No complaints were filed for agricultural burning on August 9, 2016.

IV.1.c Review of Source Permitted Inspections and Public Complaints

A query of the ICAPCD permit database was compiled and reviewed for active permitted sources throughout Imperial County and specifically around Calexico, El Centro, Niland, and Westmorland during the August 9, 2016 PM₁₀ exceedances. Both permitted and non-permitted sources are required to comply with Regulation VIII requirements that address fugitive dust emissions. The identified permitted sources are Aggregate Products, Inc., US Gypsum Quarry, Imperial Aggregates (Val-Rock, Inc., and Granite Construction), US Gypsum Plaster City, Clean Harbors (Laidlaw Environmental Services), Bullfrog Farms (Dairy), Burrtec Waste Industries, Border Patrol Inspection station, Centinela State Prison, various communications towers not listed and various

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agricultural operations. Non-permitted sources include the wind farm known as Ocotillo Express, and a solar facility known as CSolar IV West. Finally, the desert regions are under the jurisdiction of the Bureau of Land Management and the California Department of Parks (Including Anza Borrego State Park and Ocotillo Wells).

An evaluation of all inspection reports, air quality complaints, compliance reports, and other documentation indicate no evidence of unusual anthropogenic-based PM₁₀ emissions. August 9, 2016 was officially designated as a Limited Burn day. No complaints were filed on August 9, 2016 related either to agricultural or waste burning or dust.

FIGURE 4-2
PERMITTED SOURCES

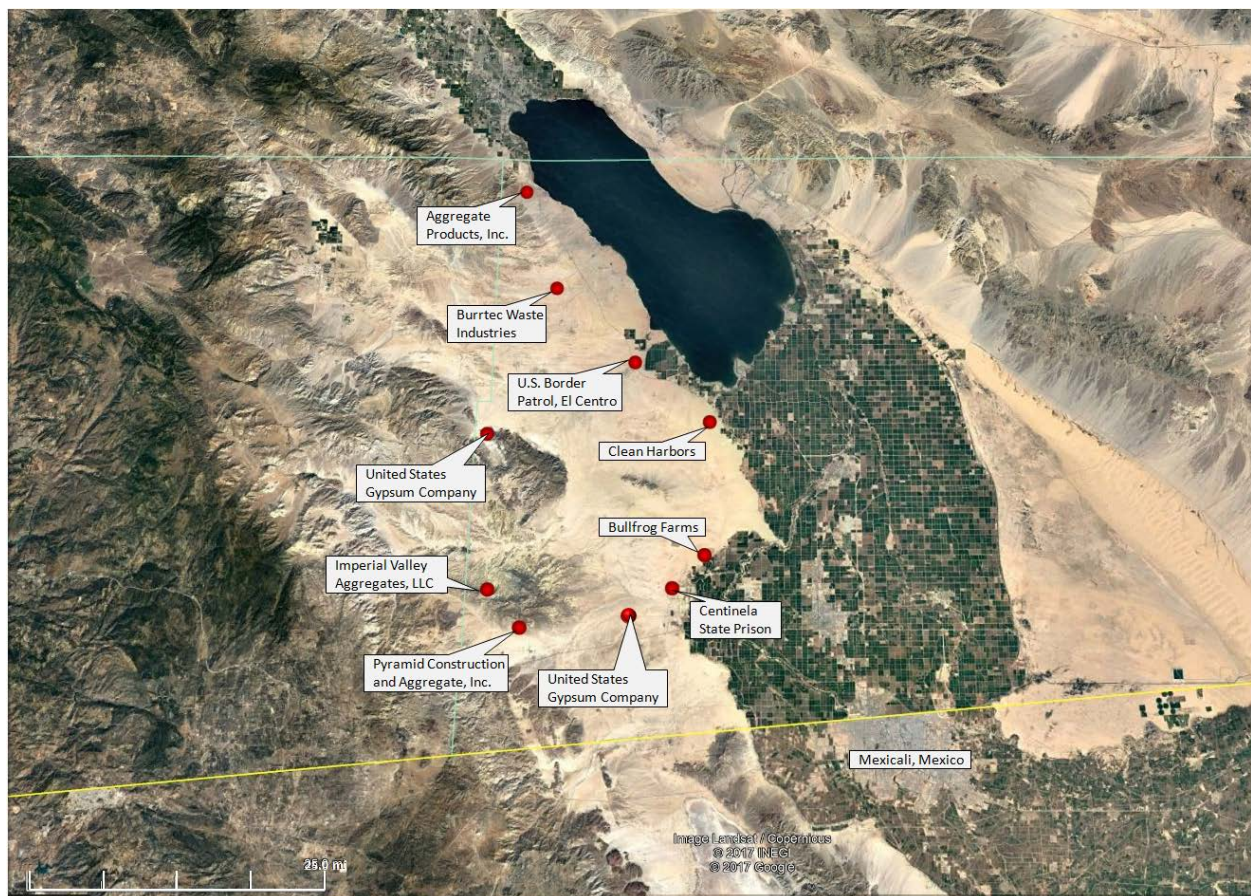


Fig 4-2: The above map identifies those permitted sources located west, northwest and southwest of the air monitors in Imperial County. The green line to the north denotes the political division between Imperial and Riverside counties. The yellow line below denotes the international border between the United States and Mexico. The green checker-boarded areas are a mixed use of agricultural and community parcels. In addition, the desert areas are managed either by the Bureau of Land Management or the California Department of Parks. Base map from Google Earth.

FIGURE 4-3
NON-PERMITTED SOURCES

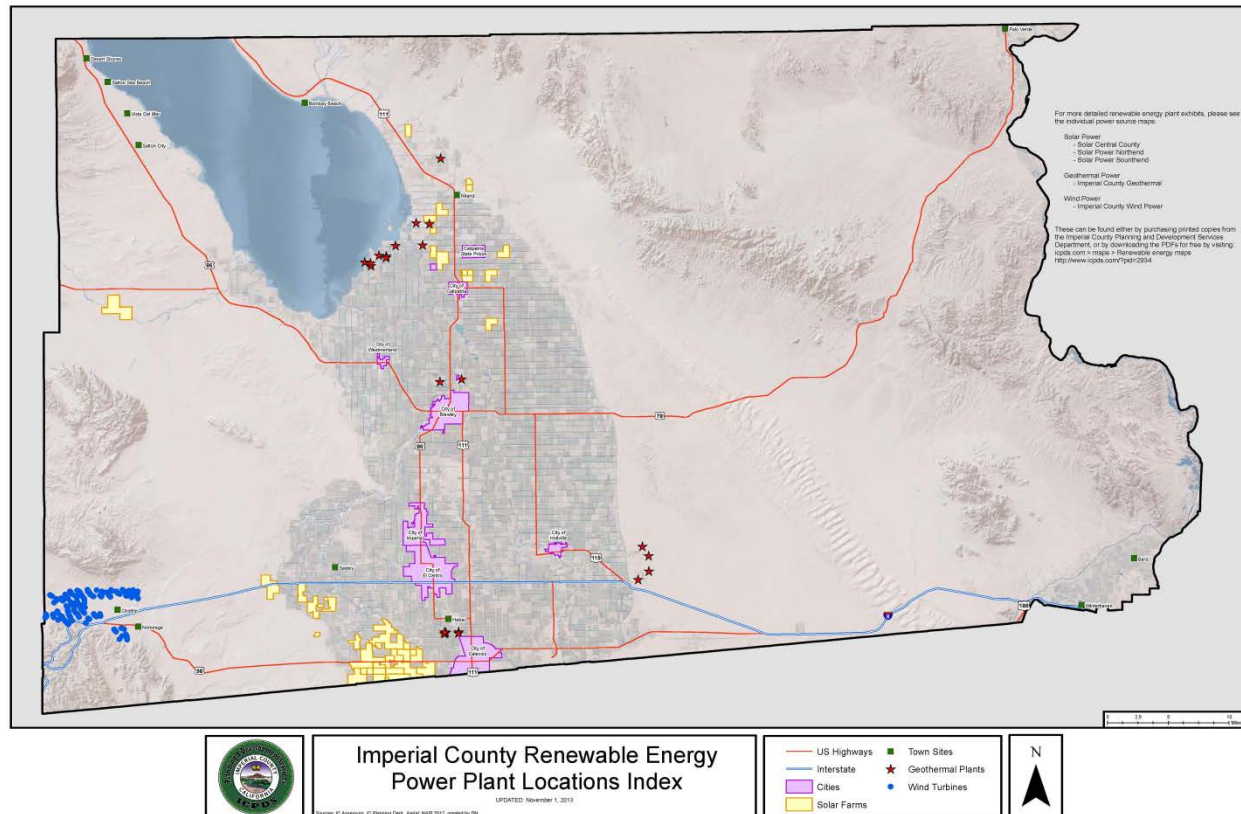


Fig 4-3: The above map identifies those power sources located west, northwest and southwest of the air monitors in Imperial County. Blue indicate the Wind Turbines, Yellow are the solar farms and stars are geothermal plants

IV.2 Forecasts and Warnings

As discussed earlier, notifications advising of the return of monsoonal storms were issued as early as August 7, 2016. The published weekend forecast included a discussion regarding a series of upper-level troughs dominating the weather pattern over Southwest California, which would keep monsoonal moisture to the east well out of the San Diego forecast area. The Phoenix NWS office concentrated its forecast discussions along south-central Arizona, specifically Maricopa County. According to the Phoenix office, convection got off to an early start across the Phoenix metro area and scattered activity would persist in Maricopa County before spreading eastward.

The published notification, via the ICAPCD's webpage, forecast for August 9, 2016 included the synopsis for the San Diego and Phoenix NWS offices. Along the coast and mountain ranges to the west of Imperial County, the San Diego NWS office identified a trough of low-pressure that would keep a dry southwest flow aloft. In addition, below average temperatures over much of Southern California through Thursday was expected. This is significant because as the cooler temperatures remain in place along the West Coast, any potential for surges related to

thunderstorm activity would be non-existent. The weather story issued by the San Diego NWS office identified no significant impacts from Javier (tropical depression) expected for Southwest California. However, the San Diego office discussed the slow movement up the Baja California coast of tropical depression Javier before dissipating by Wednesday, August 10, 2016. The tropical moisture was forecast to move up the Baja California coast and east into central Arizona.

To the east of Imperial County, the Phoenix NWS office issued a forecast of a return to more extensive thunderstorm activity over central and eastern Arizona through Thursday. The Phoenix NWS identified moisture moving into Arizona and explained that any storms that would develop would have the potential for strong winds and heavy rain along the southern and central parts of Arizona. **Appendix A** contains copies of notices pertinent to the August 9, 2016 event.

IV.3 Wind Observations

Wind data during the event were available from airports in eastern Riverside County, southeastern San Diego County, southwestern Yuma County (Arizona), northern Mexico, and Imperial County (**Table 2-2**). Data were also collected from automated meteorological instruments that were upstream from the Brawley, Calexico, El Centro, Niland, and Westmorland monitors during the wind event. On August 9, 2016 Imperial County Airport (KIPL) and the Yuma, Arizona MCAS (KNYL) measured winds at or above 25 mph for at least one hour. El Centro NAF (KNJK), KNYL, and Mexicali International Airport (MMML) in Mexicali, Mexico all reported multiple observations of blowing dust or hazy conditions. Both KNYL and MMML were important upstream sites during the wind event. San Luis Colorado, Mexico, measured winds of 25 mph with gusts of 37 mph. speeds of 25 mph are normally sufficient to overcome most PM₁₀ control measures. During the August 9, 2016 event wind speeds were at or above the 25 mph threshold, overcoming the BACM in place.

IV.4 Summary

The weather and air quality forecasts and warnings outlined in this section demonstrate that dry gusty southerly winds transported uncontrollable PM₁₀ emissions affecting air monitors on August 9, 2016. The BACM list as part of the control measures in Imperial County for fugitive dust emissions were in place at the time of the event. These control measures are required for areas designated as "serious" non-attainment for PM₁₀, such as Imperial County. Thus, the BACM in place at the time of the event were beyond reasonable. In addition, surface wind measurements at or upstream of the Calexico, El Centro, Niland, and Westmorland monitors during the event were high enough (at or above 25 mph, with wind gusts of 37 mph) that BACM PM₁₀ control measures would have been overwhelmed.

Finally, a high wind dust event can be considered as a natural event, even when portions of the wind-driven emissions are anthropogenic, as long as those emissions have a clear causal relationship to the event and were determined to be not reasonably controllable or preventable. This demonstration has shown that the event that occurred on August 9, 2016 was not reasonably controllable or preventable despite the strong and in force BACM within the affected

areas in Imperial County. This demonstration has similarly established a clear causal relationship between the exceedances and the high wind event timeline and geographic location. The August 9, 2016 event can be considered an exceptional event under the requirements of the exceptional event rule.

V Clear Causal Relationship

V.1 Discussion

Meteorological observations for August 9, 2016 identified the northward movement and intrusion of remnant moisture existing within Mexico that combined with moisture from Tropical Storm Javier along the Baja California coast into the desert southwest of the United States. Unlike, more common monsoonal intrusions, the presence of a trough within the Pacific west and the southward plunge of the Jet Stream allowed for the creation of meteorological conditions that changed the area and level of impact within the desert southwest on August 9, 2016.

The remnant moisture existing in Mexico combined with the moisture from Tropical Storm Javier and the southward jet stream in the United States gave confidence to forecast discussions of damaging wind potentials mainly along south-central Arizona with less potential to southwest Arizona and southeastern California. As discussed earlier, forecaster expectations fell short. While storm activity did occur, including blowing dust and flooding, the amount of expected moisture necessary for the high impact level of thunderstorm activity did not move as far east as previously expected. According to the NWS office in Phoenix, excessive moisture levels showed up in Yuma while the NWS office in San Diego reported areas of blowing dust in Coachella Valley, the San Diego deserts, and points east. Gusty south winds driven by the synoptic-scale flow around the base of the low-pressure trough over the western United States caused the blowing dust in southeastern California, including Imperial County.

Entrained windblown dust from natural areas, particularly from the natural open desert areas south of Imperial County, along with anthropogenic sources controlled with BACM, is confirmed by the meteorological and air quality observations on August 9, 2016.

Figures 5-1 through 5-3 provide information regarding the expected path of Tropical Storm Javier

FIGURE 5-1
TROPICAL STORM JAVIER AUGUST 8, 2016

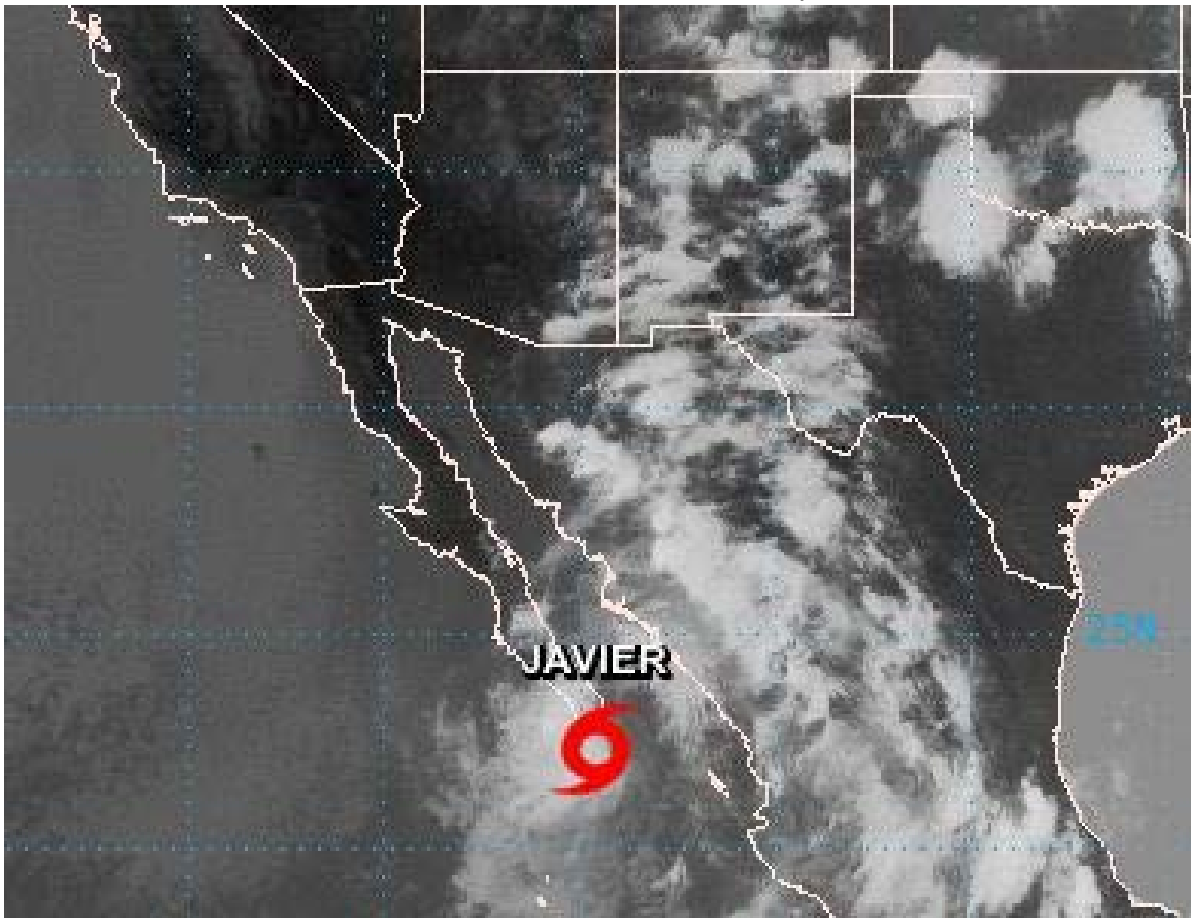


Fig 5-1: Courtesy of the article written by Cap'n Bob & the Damsel, posted August 8, 2016. The article found in **Appendix A** provides a synopsis of the position of Tropical Storm Javier and its anticipated path. The article describes the moisture movement northward and the progression of Tropical Storm Javier as meandering north-westward along the Baja Coastline. Source: Infrared image by NOAA – Cap'n Bob & the Damsel Perspectives on Life and Politics <http://capnbob.us/blog/2016/08/08/tropical-moisture-headed-for-arizona/>

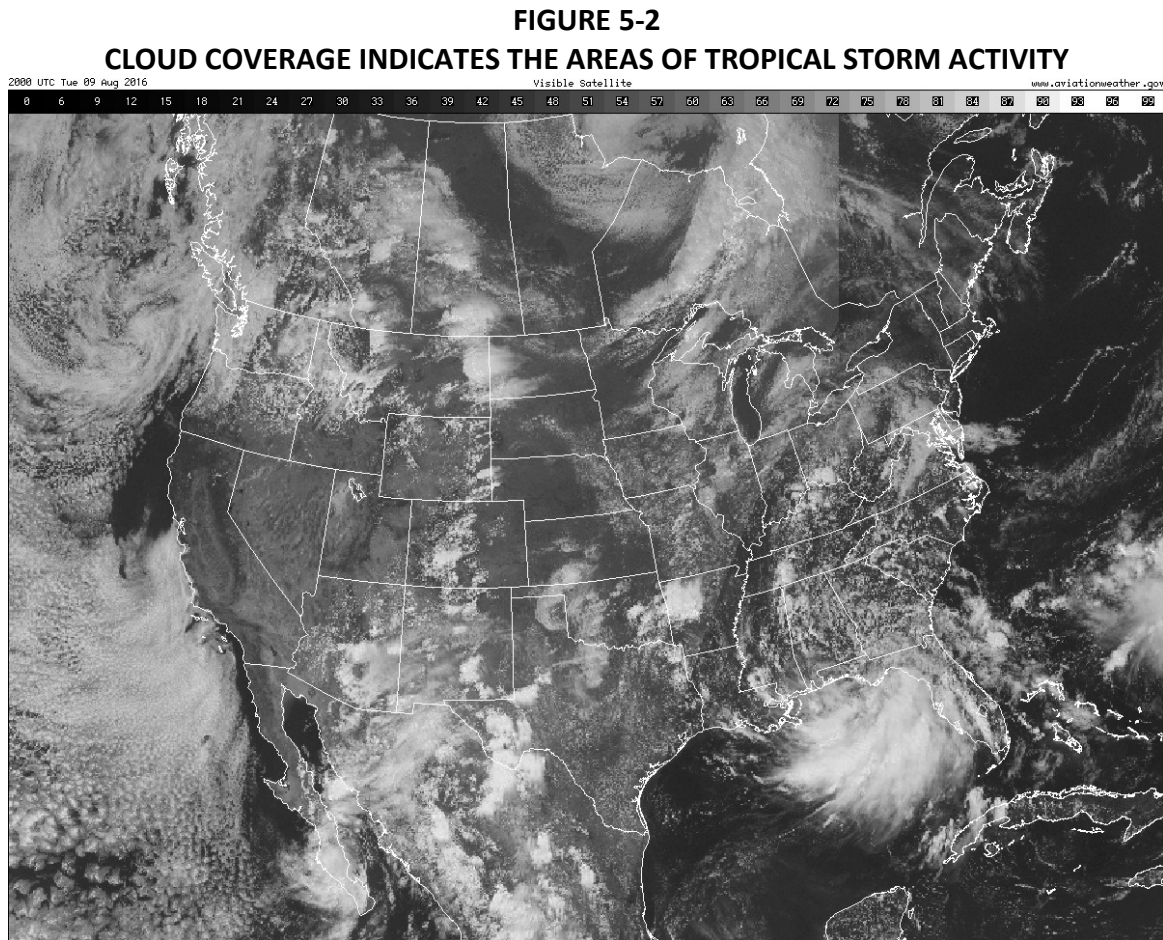


Fig 5-2: A satellite image of the clouds associated with the remnant dissipated Tropical Storm Earl and Tropical Storm Javier. The combined moisture surge northward from Mexico along with the Pacific west trough and influence of the southward plunge of the jet stream created an alley that allowed Tropical Storm Javier to reach the Baja peninsula.
<http://aviationweather.gov>

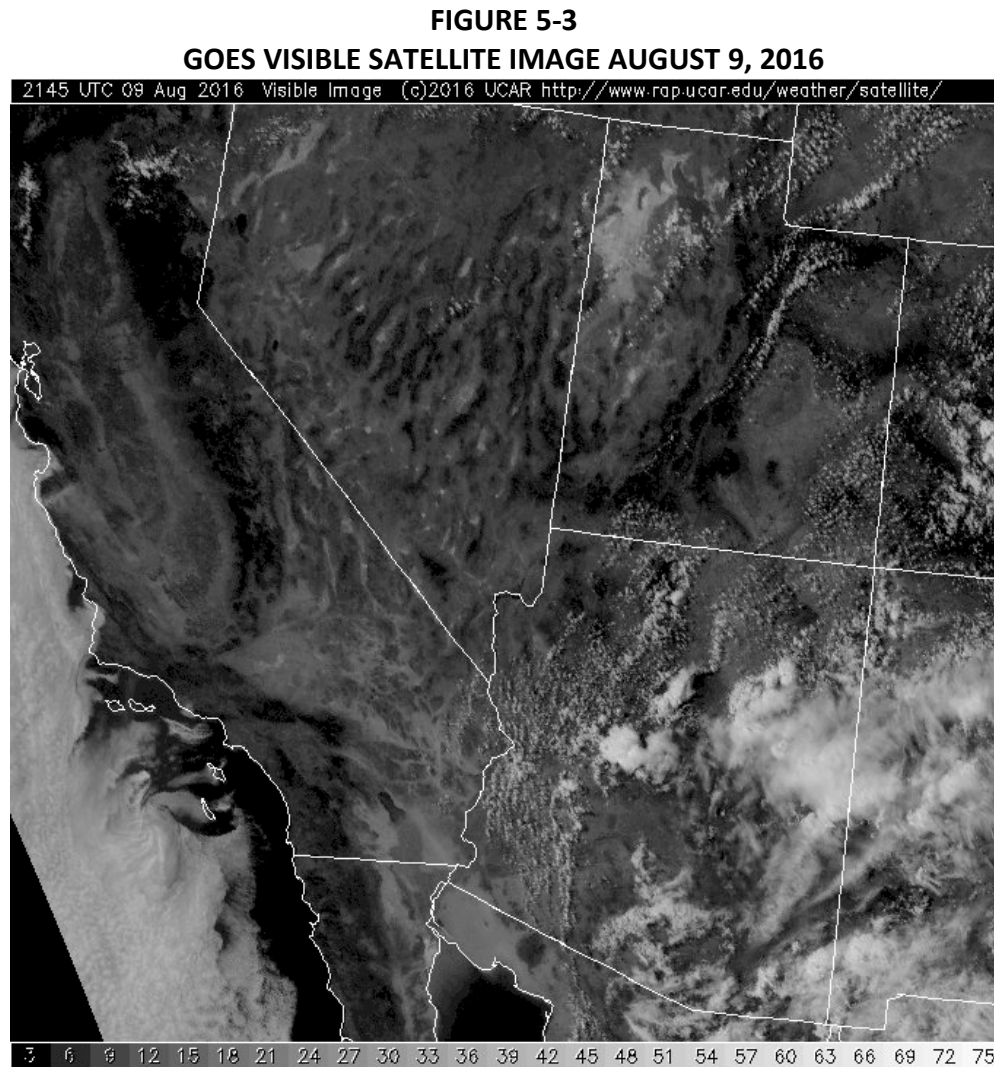


Fig 5-3: A GOES satellite image of the Southwest (1345 PST) captured what the descriptive text narrative described as dust in southern California and Arizona originating from northern Mexico. <http://weather.rap.ucar.edu>

Figure 5-4 and Figure 5-6 show the heavy Aerosol Optical Depth (AOD) over Imperial County captured by the MODIS instrument onboard the Terra and Aqua satellites on August 9, 2016.¹⁹ **Figures 5-5 and 5-7** utilize the Deep Blue Aerosol Angstrom Exponent²⁰ to differentiate between

¹⁹ Aerosol Optical Depth (AOD) (or Aerosol Optical Thickness) indicates the level at which particles in the air (aerosols) prevent light from traveling through the atmosphere. Aerosols scatter and absorb incoming sunlight, which reduces visibility. From an observer on the ground, an AOD of less than 0.1 is "clean" - characteristic of clear blue sky, bright sun and maximum visibility. As AOD increases to 0.5, 1.0, and greater than 3.0, aerosols become so dense that sun is obscured. Sources of aerosols include pollution from factories, smoke from fires, dust from dust storms, sea salt, and volcanic ash and smog. Aerosols compromise human health when inhaled by people, particularly those with asthma or other respiratory illnesses. Source: <https://worldview.earthdata.nasa.gov>

²⁰ The MODIS Deep Blue Aerosol Ångström Exponent layer can be used to provide additional information related to the aerosol particle size over land. This layer is created from the Deep Blue (DB) algorithm, originally developed for retrieving over desert/arid land (bright in the visible wavelengths). The Ångström exponent provides additional information on the particle size (larger the

the sizes of aerosols. This is useful in showing heavier aerosols that indicate dust. Progressively larger particles are indicated by progressively darker shades of green. Although the Terra satellite made its pass at ~1030 PST which was hours prior to the peak concentrations, it does support the presence of large-particle aerosols in the air. NOAA's Smoke Text Product, valid through 1945 PST August 9, 2016, confirms the presence of dust originating from northern Mexico and Arizona within the Lower Colorado River Valley (**Appendix A**).

FIGURE 5-4
TERRA MODIS CAPTURES AEROSOLS
OVER IMPERIAL COUNTY AUGUST 9, 2016

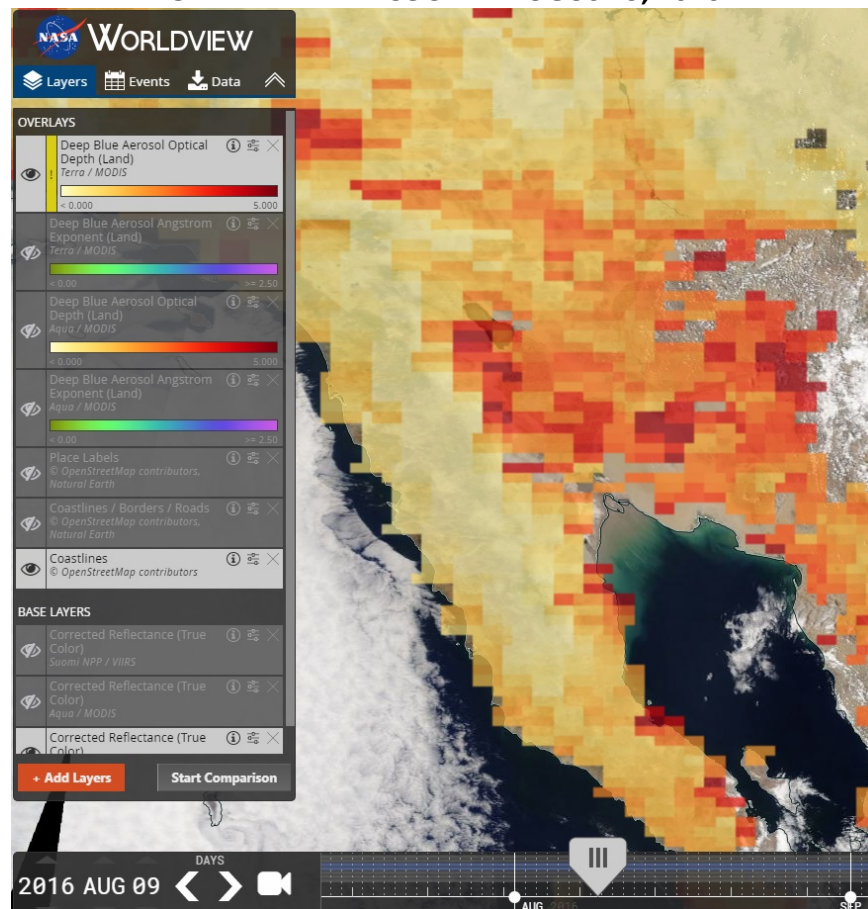


Fig 5-4: The MODIS instrument onboard the Terra satellite captured a thick layer of large particle aerosols drifting over Imperial County at ~10:30 PST on August 9, 2016. Green colors indicate thicker aerosols that are more likely dust. Source: NASA Worldview; <https://worldview.earthdata.nasa.gov>

exponent, the smaller the particle size). Values < 1 suggest optical dominance of coarse particles (e.g. dust) and values > 1 suggest optical dominance of fine particles (e.g. smoke) <https://worldview.earthdata.nasa.gov>; The Ångström Exponent (denoted as AE or α) is a measure of how the AOD changes relative to the various wavelength of light (known as 'spectral dependence'.) This is related to the aerosol particle size. Roughly speaking, values less than 1 suggest an optical dominance of coarse particles (e.g. dust, ash, sea spray), while values greater than one 1 dominance of fine particles (e.g. smoke, industrial pollution); <https://deepblue.gsfc.nasa.gov/science>

FIGURE 5-5
TERRA MODIS CAPTURES DUST-SIZED AEROSOLS
OVER IMPERIAL COUNTY AUGUST 9, 2016

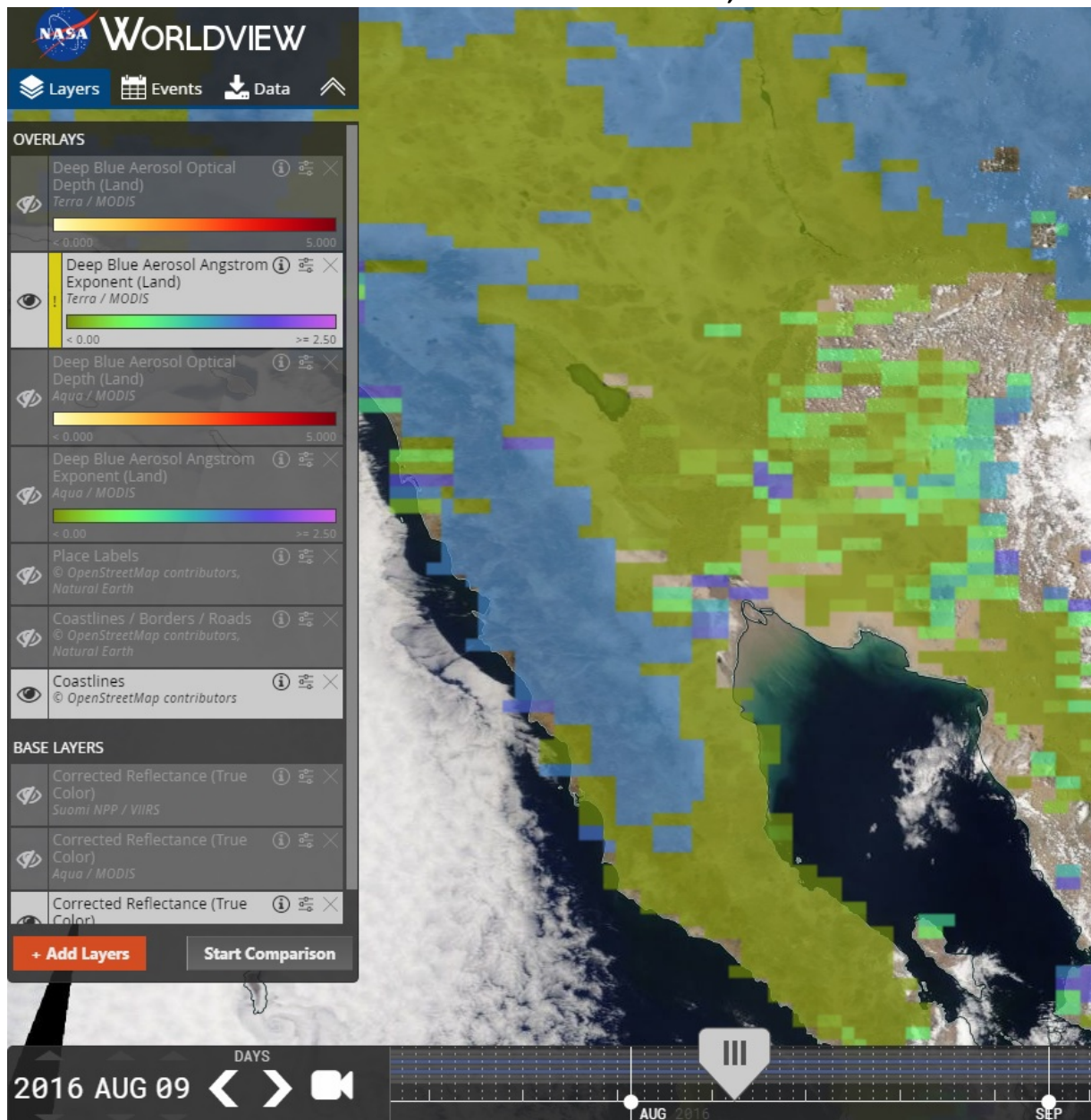


Fig 5-5: The MODIS instrument onboard the Terra satellite captured a thick layer of large particle aerosols drifting over Imperial County at ~10:30 PST on August 9, 2016. Green colors indicate thicker aerosols that are more likely dust. Source: NASA Worldview; <https://worldview.earthdata.nasa.gov>

FIGURE 5-6
AQUA MODIS CAPTURES AEROSOLS
OVER IMPERIAL COUNTY AUGUST 9, 2016

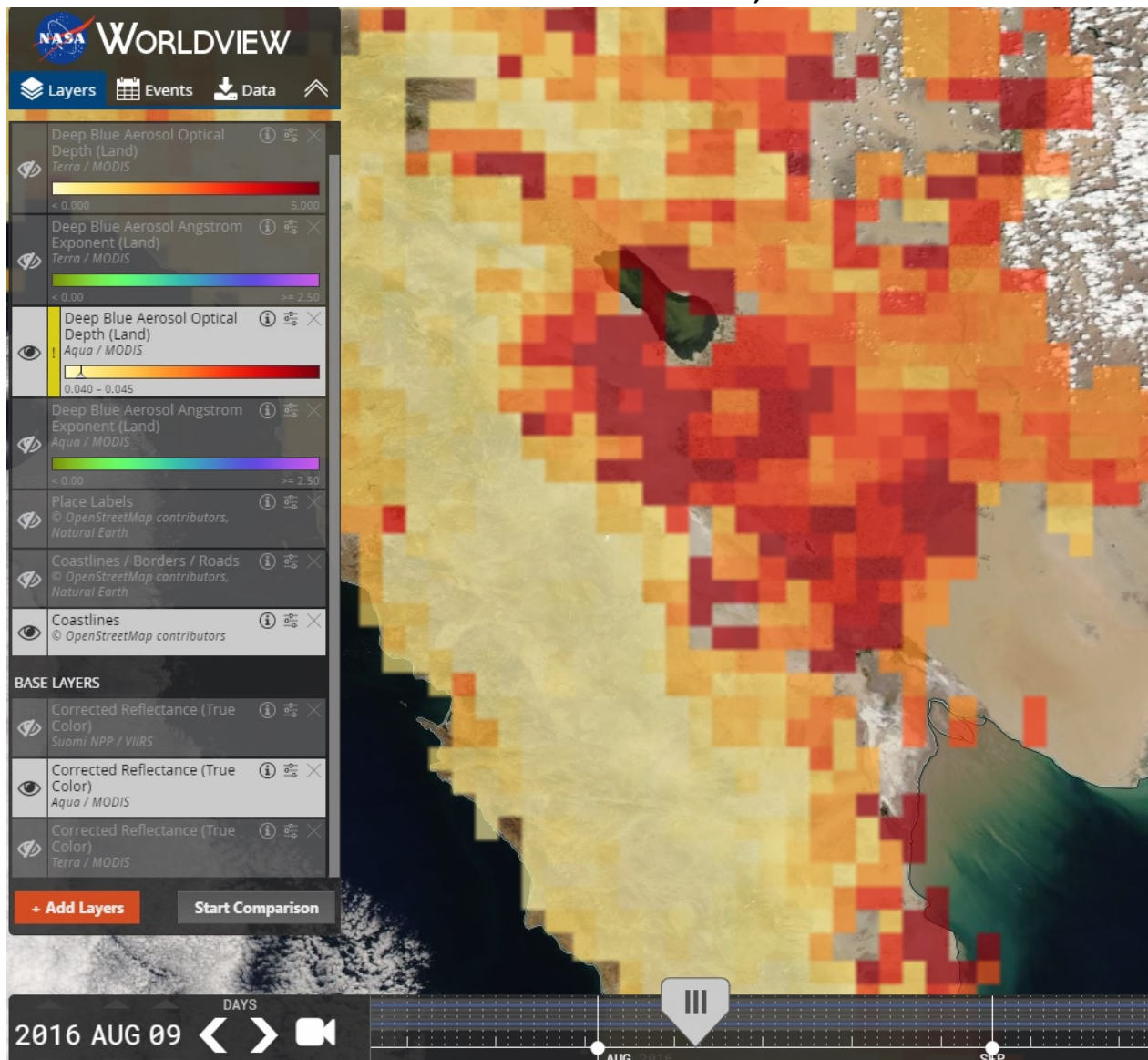


Fig 5-6: The MODIS instrument onboard the Aqua satellite captured a thick layer of large particle aerosols drifting over Imperial County at ~13:30 PST on August 9, 2016. Green colors indicate thicker aerosols that are more likely dust. Source: NASA Worldview; <https://worldview.earthdata.nasa.gov>

FIGURE 5-7
AQUA MODIS CAPTURES DUST-SIZED AEROSOLS
OVER IMPERIAL COUNTY AUGUST 9, 2016

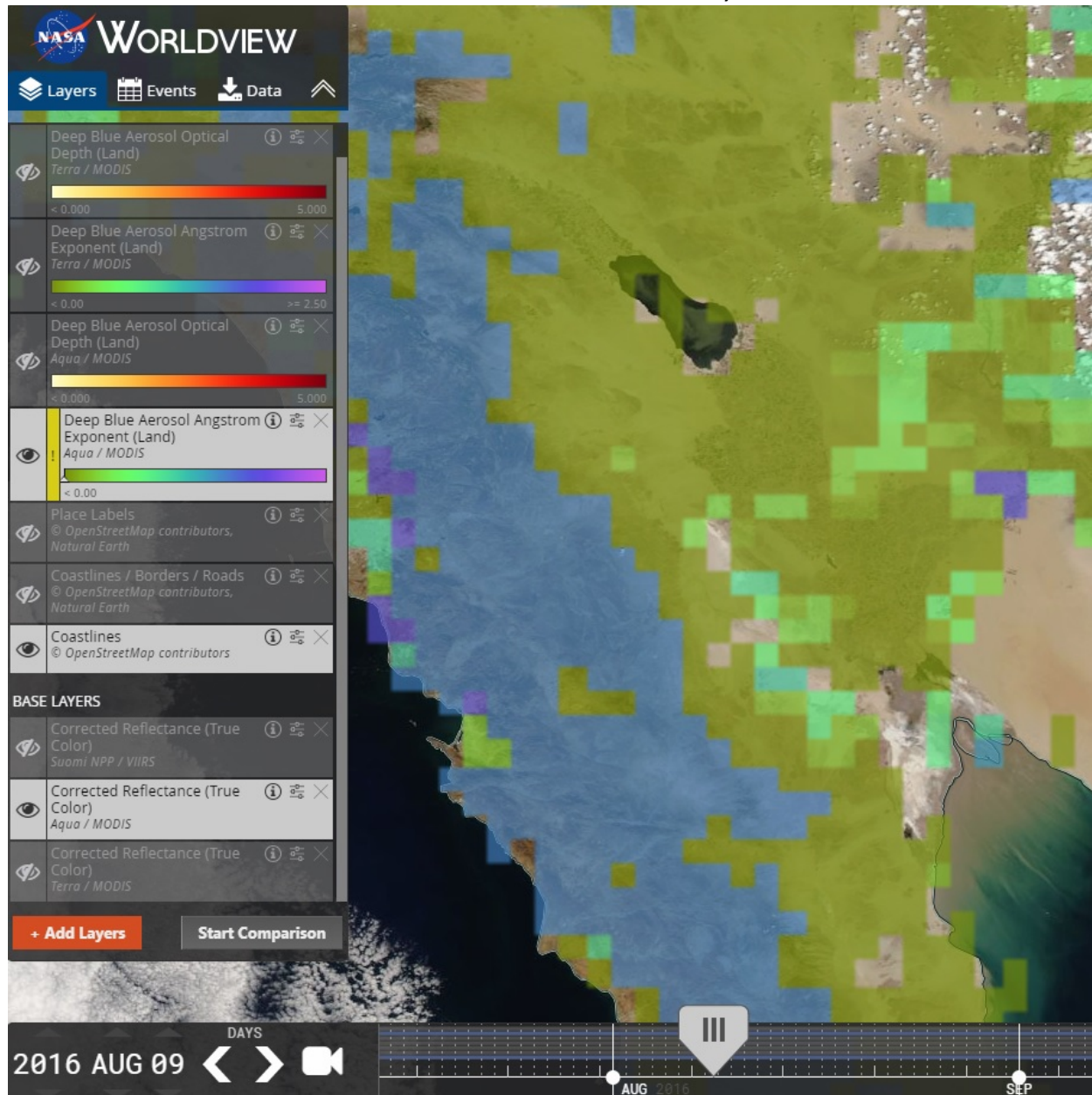


Fig 5-7: The MODIS instrument onboard the Aqua satellite captured a thick layer of large particle aerosols drifting over Imperial County at ~10:30 PST on August 9, 2016. Green colors indicate thicker aerosols that are more likely dust. Source: NASA Worldview; <https://worldview.earthdata.nasa.gov>

Figure 5-8 is a NEXRAD base reflectivity image captured by the Yuma, Arizona (KYUX) station showing the intensity of the storm-producing weather system as it moved into southeastern California. Although NEXRAD data is available only for the extreme corner of southeastern California, it helps support the intensity of the weather system and the velocity of the gusty winds that blew through the region.

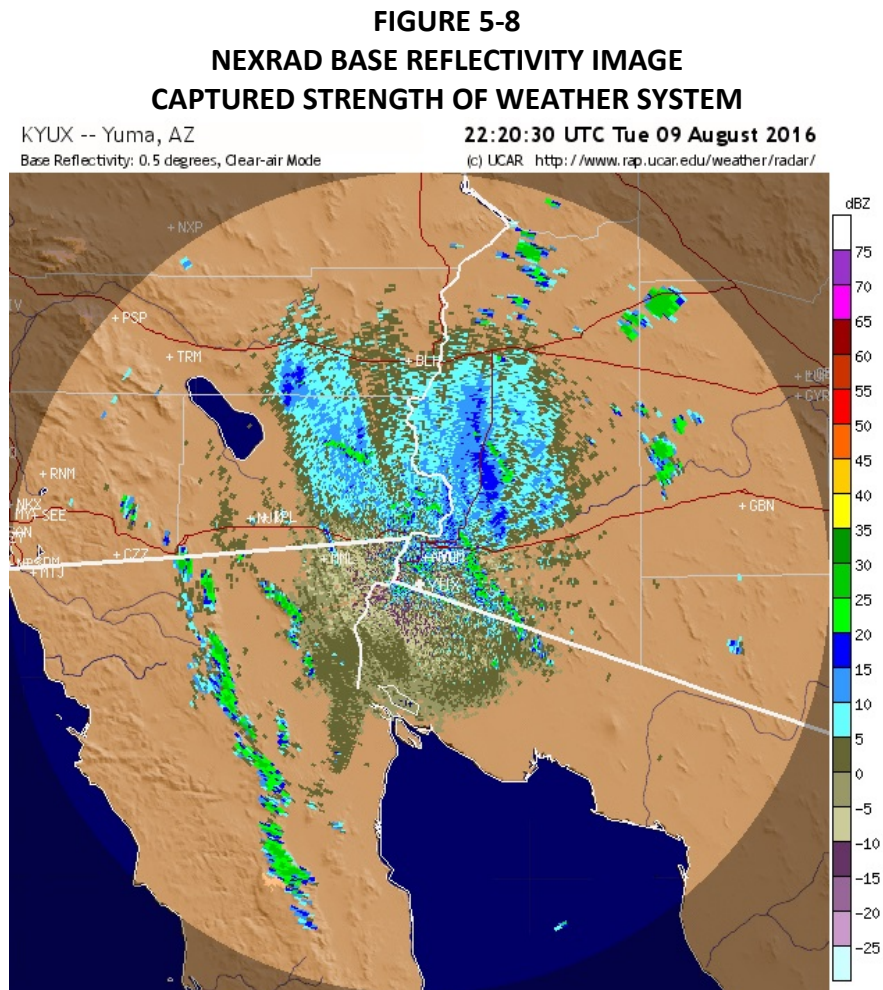


Fig 5-8: A NEXRAD base reflectivity image captured by the Yuma, Arizona (KYUX) station at 1422 PST on August 9, 2016 coincident with the hour of measured gusty winds and elevated PM₁₀ concentrations. The image shows the intensity of the storm-producing weather system as it moved into the southwest deserts. Although NEXRAD data is available only for the extreme corner of southeastern California, it helps support the intensity of the weather system and the velocity of the gusty winds that blew through the region. Source: <http://weather.rap.ucar.edu/satellite>

Figure 5-9 is a quad of Surface Observation infrared maps that depict wind barbs showing the southerly direction of winds across southeastern California. The maroon arrows show icons indicating raised dust in the southwestern corner of Arizona. The southerly winds gusting over 30 mph transported windblown dust into Imperial County.

FIGURE 5-9
SURFACE OBSERVATION IMAGES

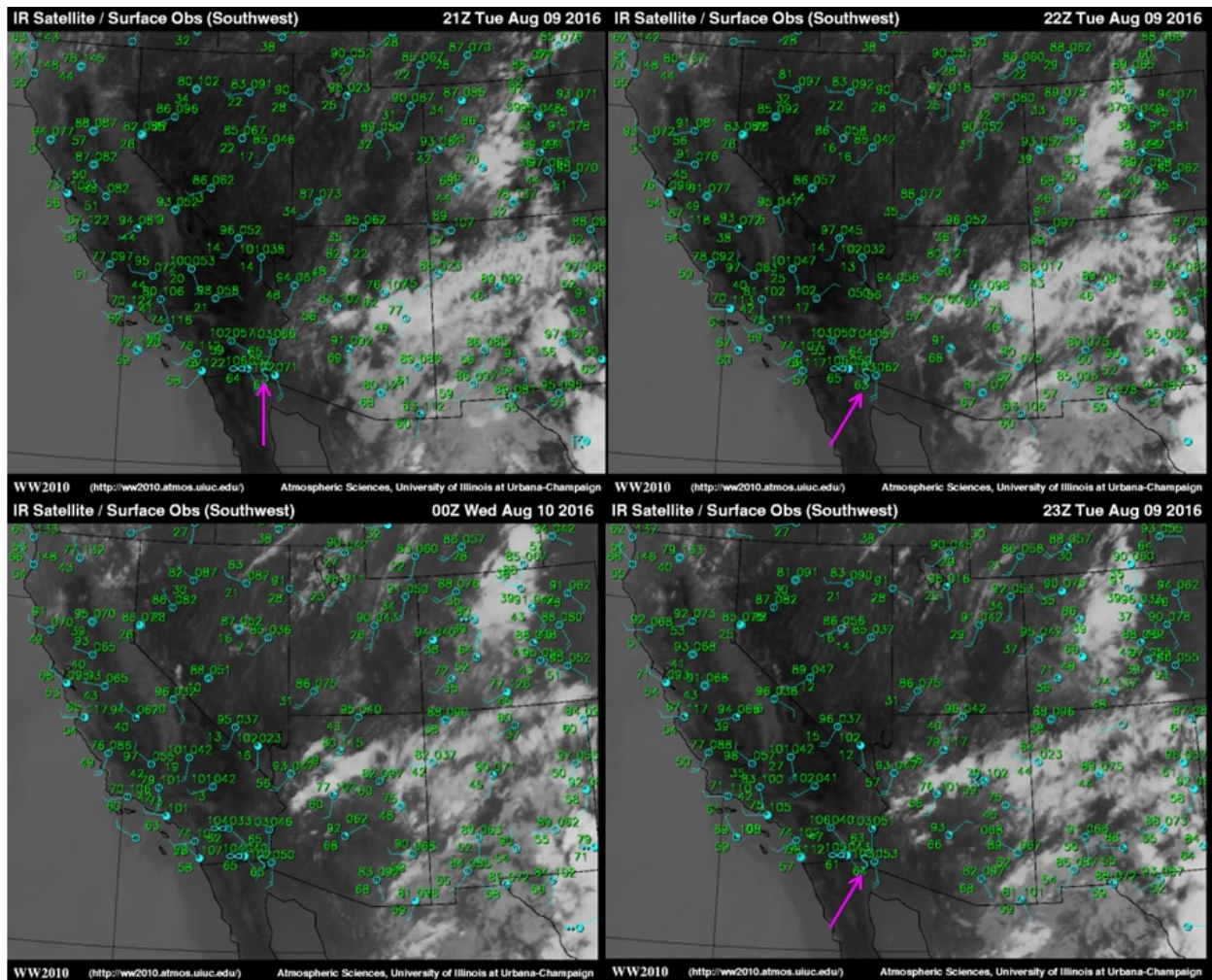


Fig 5-9: A quad of infrared Surface Observation images depicting southerly winds. The arrows point to areas of suspended dust in upstream areas from Imperial County. Clockwise from top left: 1300 PST; 1400 PST; 1500 PST; 1600 PST August 9, 2016. Source: University of Illinois Urbana-Champaign; [http://ww2010.atmos.uiuc.edu/\(Gh\)/wx/surface.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/wx/surface.rxml)

Figure 5-10 is a Wind Surface Map (1423 PST) that also indicates symbols for raised dust both at El Centro NAF (KNJK) and at Yuma MCAS in southwestern Arizona, which was upstream of Imperial County during the wind event. This was during the hour that gusty winds and high PM10 concentrations were being reported in Imperial County. Although the wind barb at KNJK indicates winds of 23 mph, winds were just above that and exceeded the 25 mph wind threshold at Imperial County Airport (KIPL).

FIGURE 5-10
SURFACE WIND MAP AUGUST 9, 2016

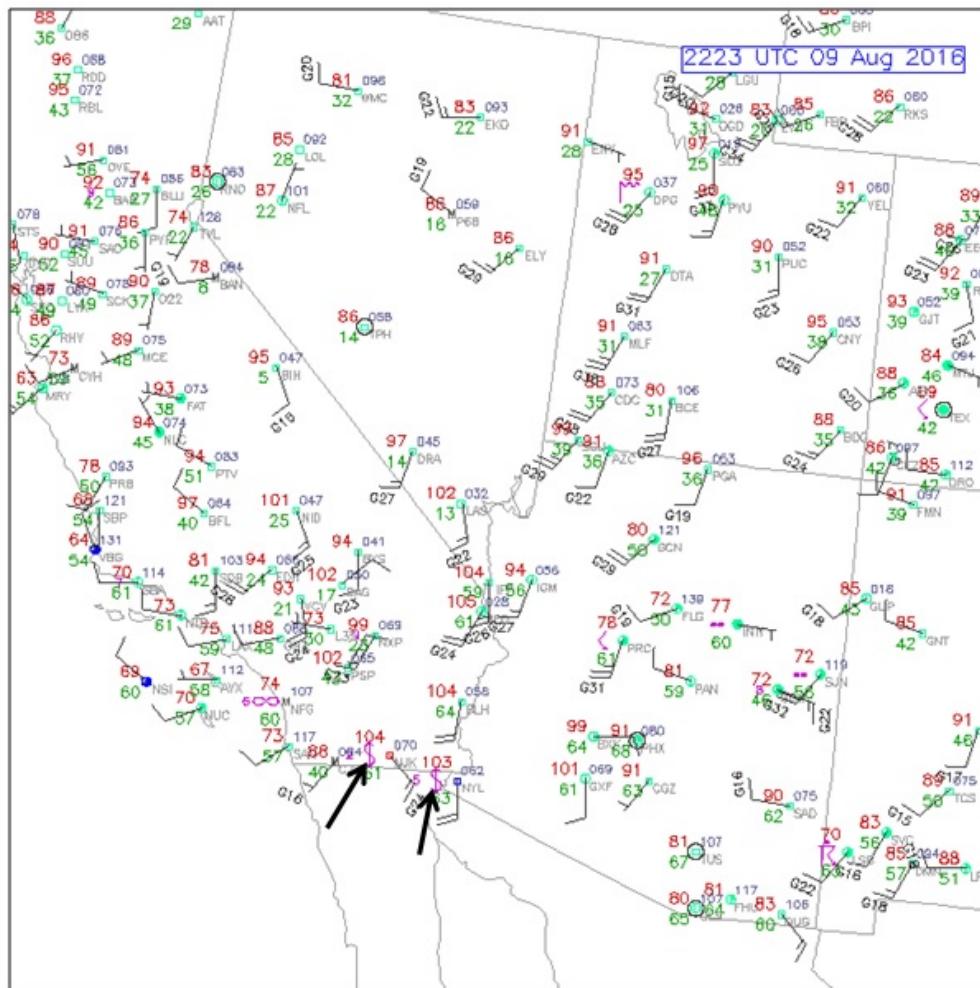


Fig 5-10: A surface wind map identifies the reported dust by both El Centro NAF (KNJK) and Yuma MCAS (KNYL). Source: <http://weather.rap.ucar.edu/satellite>

The EPA accepts a high wind threshold for sustained winds of 25 mph in California and 12 other states.²¹ **Tables 5-1 through 5-4** provide a temporal relationship of wind speeds, wind direction, wind gusts (if available), and PM₁₀ concentrations at the exceeding stations on August 9, 2016. The tables show that peak hourly concentrations took place immediately following or during the period of high upstream wind speeds.

²¹ "Treatment of Data Influenced by Exceptional Events; Final Guidance", FR Vol. 81, No. 191, 68279, October 3, 2016

TABLE 5-1
CALEXICO PM₁₀ CONCENTRATIONS AND WIND SPEEDS AUGUST 9, 2016

San Luis Colorado, MX				Mexicali, MX				Yuma, AZ MCAS					Calexico				
(SLRS6)				Intl. Airport (MMML)				(KNYL)									
HOUR	W/S	W/G	W/D	HOUR	W/S	W/D	Obs.	HOUR	W/S	W/G	W/D	Obs.	HOUR	W/S	W/D	HOUR	PM ₁₀ (µg/m ³)
0:00	7	10	128	0:00				0:57	14		160		0:00	3.2	102	0	70
1:00	8	12	130	1:00				1:57	21		150		1:00	3.5	107	100	78
2:00	7	11	141	2:00				2:57	25	31	150		2:00	2.4	101	200	58
3:00	15	21	163	3:00				3:57	25		150		3:00	2.3	99	300	67
4:00	10	16	165	4:00				4:57	23		160		4:00	0.8	93	400	44
5:00	11	18	170	5:15	8	120		5:57	25		160	DU	5:00	2.6	106	500	59
6:00	16	24	171	6:46	9	140		6:57	18		160	DU	6:00	5.8	130	600	68
7:10	17	26	186	7:46	10	160		7:57	18		150	DU	7:00	7.1	160	700	71
8:20	15	27	172	8:51	9	130		8:57	15	23	140		8:00	3.2	236	800	77
9:00	20	29	163	9:52	8	160		9:57	20	31	140		9:00	1	258	900	53
10:20	18	30	183	10:46	17	150		10:57	22	31	160		10:00	4	127	1000	54
11:50	21	33	189	11:30	18	150	BLDU	11:57	23	33	170	DU	11:00	9.7	128	1100	95
12:50	25	37	194	12:49	19	160	BLDU	12:57	24	30	160	DU	12:00	13	124	1200	387
13:30	22	37	188	13:55	89	140	BLDU	13:57	22		180	DU	13:00	14	122	1300	630
14:30	23	33	194	14:48	5	160	BLDU	14:57	22		170	DU	14:00	15	124	1400	815
15:00	21	30	192	15:28	24	130	BLDU	15:57	20		180	DU	15:00	13	139	1500	370
16:00	20	32	188	16:48	21	170	BLDU	16:57	16		170		16:00	13	120	1600	222
17:00	20	29	193	17:00				17:57	17		170		17:00	12	132	1700	138
18:00	19	29	192	18:00				18:57	9		170		18:00	11	132	1800	130
19:00	18	27	192	19:49	13	150		19:57	14		180		19:00	9.6	130	1900	99
20:00	14	23	185	20:53	12	130		20:57	10		170		20:00	9	127	2000	59
21:00	14	20	176	21:50	10	120		21:57	16		160		21:00	8.3	127	2100	38
22:00	13	18	162	22:54	10	110		22:57	16		140		22:00	7.2	116	2200	34
23:00	13	20	157	23:40	5	120		23:57	16		150		23:00	6.7	114	2300	17

*Wind data for KNYL, from the NCEI's QCLCD system. Calexico PM₁₀ data from AQS. Calexico does not report wind gusts. Mexicali Airport wind data and San Luis Colorado from the University of Utah's MesoWest. Wind speeds = mph; Direction = degrees. BLDU= blowing dust. DU=Widespread/Raised Dust

TABLE 5-2
EL CENTRO PM₁₀ CONCENTRATIONS AND WIND SPEEDS AUGUST 9, 2016

San Luis Colorado, MX				Mexicali, MX				Yuma, AZ MCAS					El Centro				
(SLRS6)				Intl. Airport (MMML)				(KNYL)									
HOUR	W/S	W/G	W/D	HOUR	W/S	W/D	Obs.	HOUR	W/S	W/G	W/D	Obs.	HOUR	W/S	W/D	HOUR	PM ₁₀ (µg/m ³)
0:00	7	10	128	0:00				0:57	14		160		0:00	3.9	30	0	46
1:00	8	12	130	1:00				1:57	21		150		1:00	2.2	100	100	36
2:00	7	11	141	2:00				2:57	25	31	150		2:00	3.2	97	200	37
3:00	15	21	163	3:00				3:57	25		150		3:00	3.3	91	300	28
4:00	10	16	165	4:00				4:57	23		160		4:00	3.8	79	400	35
5:00	11	18	170	5:15	8	120		5:57	25		160	DU	5:00	3.3	45	500	47
6:00	16	24	171	6:46	9	140		6:57	18		160	DU	6:00	5.9	88	600	64
7:10	17	26	186	7:46	10	160		7:57	18		150	DU	7:00	3.9	129	700	77
8:20	15	27	172	8:51	9	130		8:57	15	23	140		8:00	3.1	206	800	62
9:00	20	29	163	9:52	8	160		9:57	20	31	140		9:00	1.4	267	900	55
10:20	18	30	183	10:46	17	150		10:57	22	31	160		10:00	4.5	118	1000	55
11:50	21	33	189	11:30	18	150	BLDU	11:57	23	33	170	DU	11:00	6.9	124	1100	74
12:50	25	37	194	12:49	19	160	BLDU	12:57	24	30	160	DU	12:00	9.3	129	1200	200
13:30	22	37	188	13:55	89	140	BLDU	13:57	22		180	DU	13:00	11	131	1300	631
14:30	23	33	194	14:48	5	160	BLDU	14:57	22		170	DU	14:00	12	127	1400	652
15:00	21	30	192	15:28	24	130	BLDU	15:57	20		180	DU	15:00	14	130	1500	871
16:00	20	32	188	16:48	21	170	BLDU	16:57	16		170		16:00	13	130	1600	366
17:00	20	29	193	17:00				17:57	17		170		17:00	11	133	1700	141
18:00	19	29	192	18:00				18:57	9		170		18:00	9.7	139	1800	118
19:00	18	27	192	19:49	13	150		19:57	14		180		19:00	8.9	145	1900	95
20:00	14	23	185	20:53	12	130		20:57	10		170		20:00	7.4	143	2000	42
21:00	14	20	176	21:50	10	120		21:57	16		160		21:00	5.9	125	2100	30
22:00	13	18	162	22:54	10	110		22:57	16		140		22:00	4.9	113	2200	31
23:00	13	20	157	23:40	5	120		23:57	16		150		23:00	5.6	119	2300	24

*Wind data for KNYL, from the NCEI's QCLCD system. El Centro PM₁₀ data from AQS. El Centro does not report wind gusts. Mexicali Airport wind data and San Luis Colorado from the University of Utah's MesoWest. Wind speeds = mph; Direction = degrees. BLDU= blowing dust. DU=Widespread/Raised Dust

TABLE 5-3
NILAND PM₁₀ CONCENTRATIONS AND WIND SPEEDS AUGUST 9, 2016

IMPERIAL CO. AIRPORT (KIPL)				EL CENTRO NAF (KNJK)					Yuma, AZ MCAS (KNYL)					Niland				
HOUR	W/S	W/D	W/G	HOUR	W/S	W/D	W/G	Obs.	HOUR	W/S	W/G	W/D	Obs.	HOUR	W/S	W/D	HOUR	PM ₁₀ (µg/m ³)
0:53	3	VR		0:56	7	280			0:57	14		160		0:00	8.2	121	0	28
1:53	6	110		1:56	0	0			1:57	21		150		1:00	8.8	115	100	25
2:53	7	80		2:56	0	0			2:57	25	31	150		2:00	8.8	123	200	27
3:53	0	0		3:56	0	0			3:57	25		150		3:00	7.9	131	300	29
4:53	0	0		4:56	0	0			4:57	23		160		4:00	6.8	129	400	37
5:53	6	80		5:56	6	320			5:57	25		160	DU	5:00	1.1	120	500	30
6:53	9	110		6:56	5	40			6:57	18		160	DU	6:00	6.4	114	600	52
7:53	6	130		7:56	5	VR			7:57	18		150	DU	7:00	9.8	131	700	51
8:53	3	VR		8:56	0	0			8:57	15	23	140		8:00	8.7	136	800	75
9:53	7	VR		9:56	5	350			9:57	20	31	140		9:00	6.6	135	900	73
10:53	9	150	20	10:56	9	140			10:57	22	31	160		10:00	8.2	145	1000	165
11:53	17	150	24	11:56	8	210			11:57	23	33	170	DU	11:00	9.6	149	1100	71
12:53	22	150	30	12:56	9	130	24		12:57	24	30	160	DU	12:00	12	154	1200	139
13:10	25	120	32	13:56	15	140	28	BLDU	13:57	22		180	DU	13:00	15	146	1300	857
14:53	23	140		14:56	23	130		BLDU	14:57	22		170	DU	14:00	16	147	1400	737
15:36	28	140	34	15:56	23	130		BLDU	15:57	20		180	DU	15:00	15	140	1500	495
16:01	28	140	34	16:56	24	130	31	BLDU	16:57	16		170		16:00	18	147	1600	467
17:53	22	140	26	17:17	23	130		BLDU	17:57	17		170		17:00	17	147	1700	323
18:53	17	140		18:56	17	140			18:57	9		170		18:00	11	140	1800	171
19:53	16	150		19:56	16	150			19:57	14		180		19:00	12	128	1900	76
20:53	10	140		20:56	8	160			20:57	10		170		20:00	12	132	2000	38
21:53	11	130		21:56	0	0			21:57	16		160		21:00	11	139	2100	22
22:53	5	120		22:56	6	50			22:57	16		140		22:00	7.2	129	2200	14
23:53	7	140		23:56	8	100			23:57	16		150		23:00	7.1	123	2300	16

*Wind data for KNYL, KIPL, and KNJK from the NCEI's QCLCD system. Niland PM₁₀ data from AQS. Niland does not report wind gusts. Wind speeds = mph; Direction = degrees. BLDU= blowing dust. DU=Widespread/Raised Dust

TABLE 5-4
WESTMORLAND PM₁₀ CONCENTRATIONS AND WIND SPEEDS AUGUST 9, 2016

IMPERIAL CO. AIRPORT (KIPL)				EL CENTRO NAF (KNJK)					Yuma, AZ MCAS (KNYL)					Westmorland				
HOUR	W/S	W/D	W/G	HOUR	W/S	W/D	W/G	Obs.	HOUR	W/S	W/G	W/D	Obs.	HOUR	W/S	W/D	HOUR	PM ₁₀ (µg/m ³)
0:53	3	VR		0:56	7	280			0:57	14		160		0:00	2.5	256	0	27
1:53	6	110		1:56	0	0			1:57	21		150		1:00	4	212	100	103
2:53	7	80		2:56	0	0			2:57	25	31	150		2:00	4.2	201	200	44
3:53	0	0		3:56	0	0			3:57	25		150		3:00	2.5	190	300	44
4:53	0	0		4:56	0	0			4:57	23		160		4:00	2.1	165	400	55
5:53	6	80		5:56	6	320			5:57	25		160	DU	5:00	1.5	253	500	121
6:53	9	110		6:56	5	40			6:57	18		160	DU	6:00	1.2	17	600	84
7:53	6	130		7:56	5	VR			7:57	18		150	DU	7:00	5.4	124	700	70
8:53	3	VR		8:56	0	0			8:57	15	23	140		8:00	4.5	132	800	137
9:53	7	VR		9:56	5	350			9:57	20	31	140		9:00	3.1	116	900	52
10:53	9	150	20	10:56	9	140			10:57	22	31	160		10:00	3.8	152	1000	67
11:53	17	150	24	11:56	8	210			11:57	23	33	170	DU	11:00	7.7	132	1100	82
12:53	22	150	30	12:56	9	130	24		12:57	24	30	160	DU	12:00	9.7	142	1200	168
13:10	25	120	32	13:56	15	140	28	BLDU	13:57	22		180	DU	13:00	13	132	1300	846
14:53	23	140		14:56	23	130		BLDU	14:57	22		170	DU	14:00	13	134	1400	556
15:36	28	140	34	15:56	23	130		BLDU	15:57	20		180	DU	15:00	15	137	1500	809
16:01	28	140	34	16:56	24	130	31	BLDU	16:57	16		170		16:00	14	139	1600	334
17:53	22	140	26	17:17	23	130		BLDU	17:57	17		170		17:00	14	140	1700	197
18:53	17	140		18:56	17	140			18:57	9		170		18:00	12	142	1800	80
19:53	16	150		19:56	16	150			19:57	14		180		19:00	12	140	1900	40
20:53	10	140		20:56	8	160			20:57	10		170		20:00	7.5	151	2000	23
21:53	11	130		21:56	0	0			21:57	16		160		21:00	6	158	2100	25
22:53	5	120		22:56	6	50			22:57	16		140		22:00	6.5	131	2200	21
23:53	7	140		23:56	8	100			23:57	16		150		23:00	6.4	124	2300	22

*Wind data for KNYL, KIPL, and KNJK from the NCEI's QCLCD system. Westmorland PM₁₀ data from AQS. Westmorland does not report wind gusts. Wind speeds = mph; Direction = degrees. BLDU= blowing dust. DU=Widespread/Raised Dust

As a reminder, NWS began discussion the return of monsoonal moisture as early as August 5, 2016. Essentially, the remnant moisture existing in Mexico combined with the moisture from Tropical Storm Javier and the southward jet stream in the United States gave confidence to forecast discussions of damaging wind potentials mainly along south-central Arizona with less potential to southwest Arizona.

The expectation was that the initial surge of humidity would provide an ideal balance between the moisture needed to initiate convection and the dry air needed to generate downbursts. In addition to this, the San Diego NWS office identified a large upper level trough along the West Coast, which would remain through Wednesday before moving inland. Accompanying the expected minor cooling would be gusty southwest to west winds within the mountains and below

the desert passes each afternoon and evening. Thus providing confidence to the forecast that a north/south dry line described as wavering back and forth along the Colorado River through Wednesday would keep thunderstorm activity, in particular rainfall, focused on the south-central Arizona deserts and mountains generally along Prescott- Phoenix and Tucson.²² However, the outcome of the timing of the event did not go quite as expected.

By late evening on August 9, 2016 the San Diego NWS office released an area forecast discussion indicating that gusty south winds over the lower deserts generated areas of blowing dust in the Coachella Valley, the San Diego deserts and points east. The winds driven by a synoptic-scale flow around the base of the low-pressure trough over the western United States came as an unexpected event.

The Phoenix NWS office confirmed that as the initial surge of moisture moved northward, with the Pacific west trough in place, and the increasing jet stream, meteorological conditions were conducive to gusty southerly winds along the desert southwest, with areas to the south and east of Imperial County transitioning to rain, by Wednesday, August 10, 2016.

Locally, all airports, including the Yuma MCAS (KNYL) and Mexicali International Airport all measured elevated gusty winds during the mid-morning to afternoon hours of August 9, 2016. KNYL reported blowing dust between the hours of 0657 PST and 1657 PST while the Mexicali airport reported blowing dust between 1130 PST to 1648 PST August 9, 2016.

Figure 5-11 is a reproduction of **Figure 2-26** illustrating the existing meteorological conditions that allowed for a synoptic-scale flow around the base of the low-pressure trough over the western United States that drove the gusty southerly winds within Imperial County. These gusty southerly winds transported windblown dust into Imperial County causing an exceedance at four out of five air monitors. The Brawley monitor measured elevated concentrations but failed to exceed the standard.

²² Area Forecast Discussion, National Weather Service Phoenix AZ, 330 AM MST (230 AM PST) Tuesday, August 9, 2016.

FIGURE 5-11
EXCEEDANCE ANALYSIS FOR TUESDAY, AUGUST 9, 2016

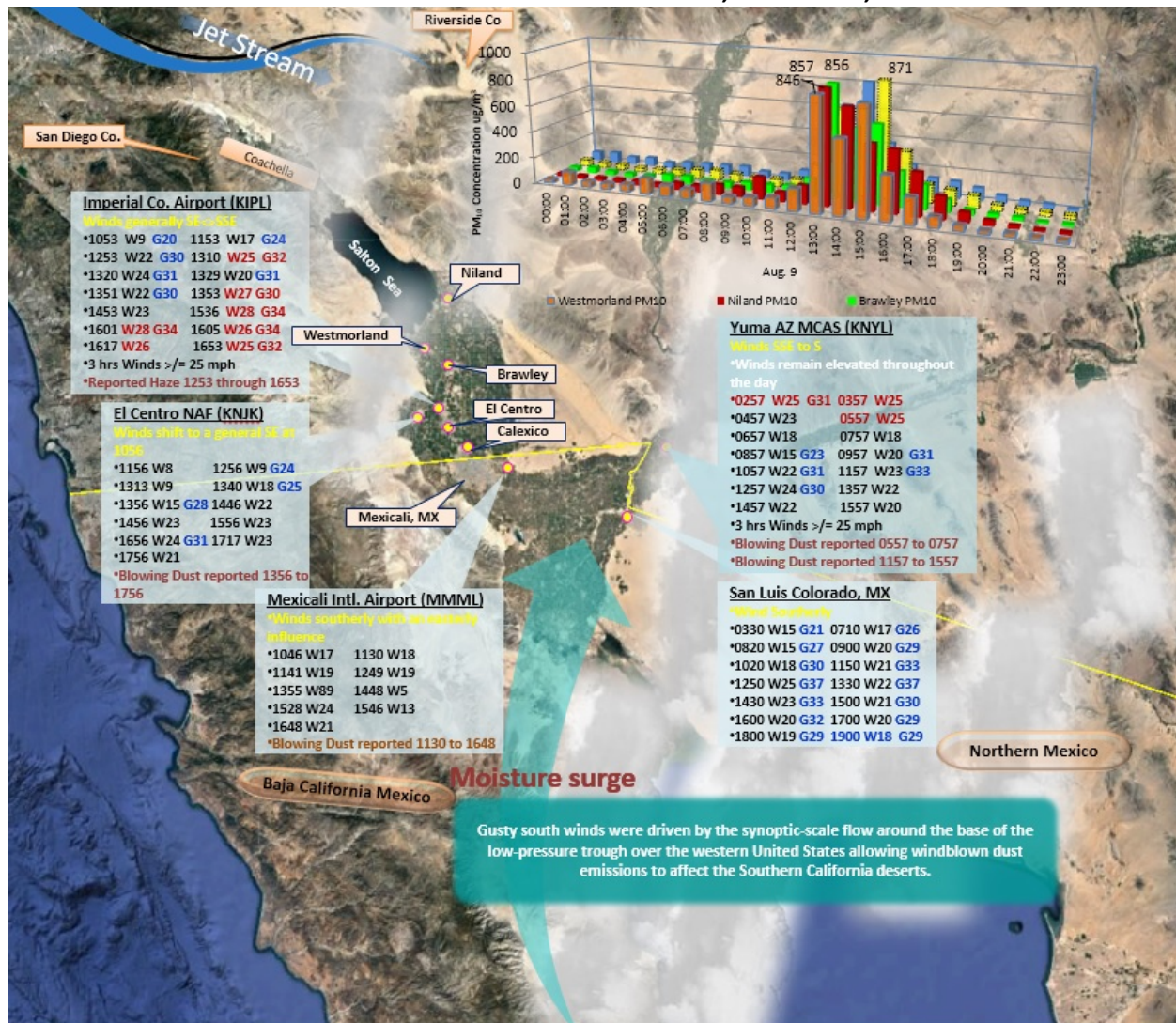


Fig 5-11: Gusty southerly winds resulting from a synoptic-scale flow around the base of the low-pressure trough over the western United States affected Imperial County on August 9, 2016. The meteorological conditions on August 9, 2016 included the initial moisture surge northward into the desert southwest from Mexico, the Pacific west trough and an increasing jet stream. These meteorological conditions allowed for gusty southerly winds to impact southeastern California, during the afternoon hours of August 9, 2016. As the Jet Stream continued to increase, meteorological conditions transitioned to rainfall east of Imperial County allowing for less suspended particulates. All times adjusted to PST. Google Earth base map

Figure 5-12 depicts a 12-hour HYSPLIT forward-trajectory starting at 0400 PST on August 9, 2016. While difficult to see the times are all inclusive within the larger image while the inset provides times for the 10 meter level at 1400 coincident with the two hour time frame when all monitors measured peak concentrations. Windblown dust originating from areas as far south as Baja California in Mexico transported dust into Imperial County on August 9, 2016.

FIGURE 5-12
FORWARD HYSPLIT TRAJECTORY ENTRAINMENT PATH AUGUST 9, 2016

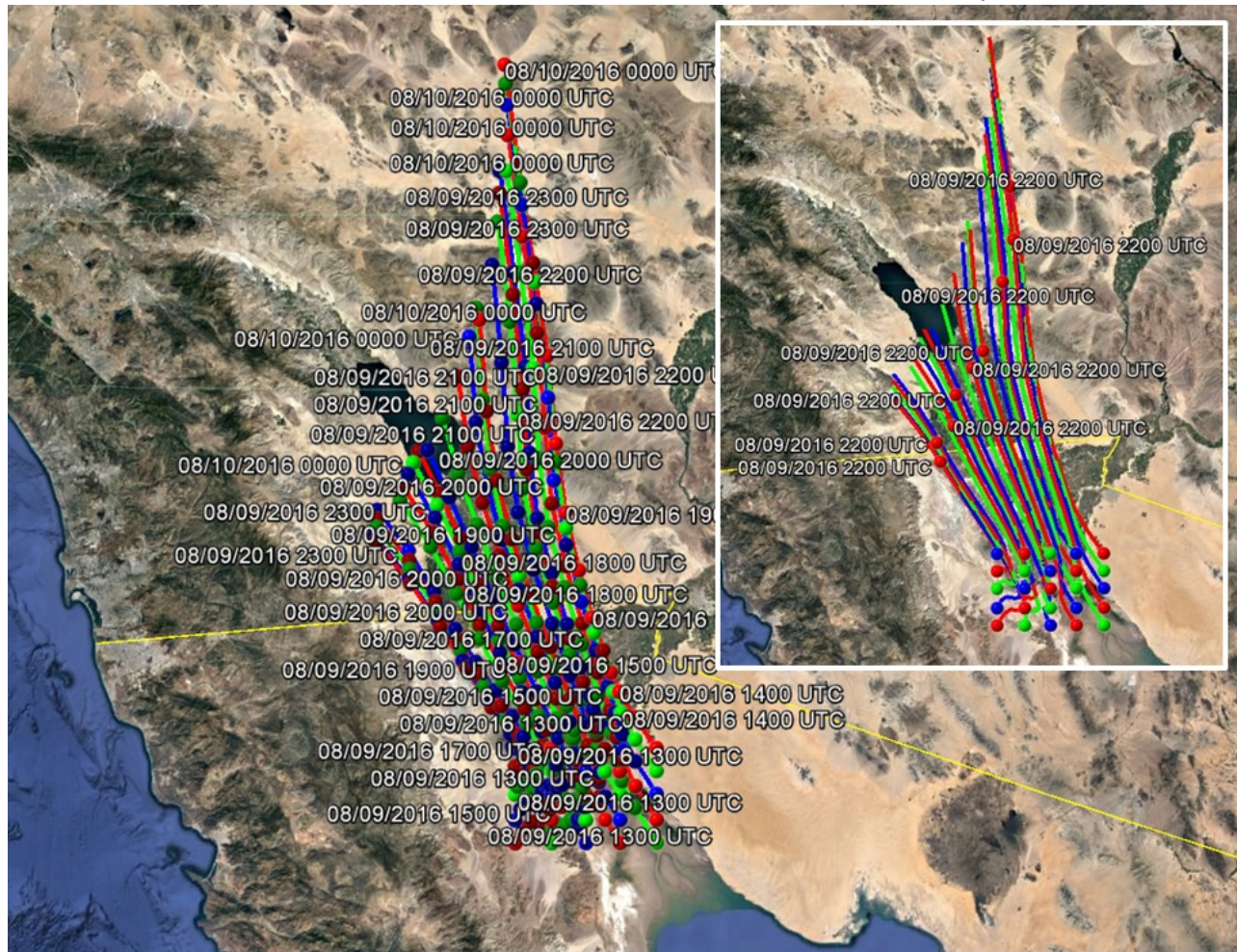


Fig 5-12: A 12-hour HYSPLIT forward-trajectory starting at 0400 on August 9, 2016 illustrates airflow over natural open deserts, farmland and populated centers in Mexico before entering the United States where windblown dust affected air quality and caused an exceedance in Imperial County. Red trajectory indicates airflow at 10 meters AGL (above ground level); blue indicates airflow at 100m. Yellow line indicates the international border. Aqua lines denote county boundaries. Dynamically generated through NOAA's Air Resources Laboratory HYSPLIT model. Base map from Google Earth

Figures 5-13 through 5-17 depict PM₁₀ concentrations and wind speeds over a 72-hour period at Brawley, Calexico, El Centro, and Westmorland. Fluctuations in hourly concentrations at the monitors over 72 hours illustrate a positive correlation with wind speeds and gusts at upstream sites. As mentioned above, the Brawley monitor, while not measuring a 24-hour exceedance, did measure elevated concentrations just shy of an exceedance. Out of all the five monitors, the Brawley location has several tall trees to the south, beyond a ¼ mile that would have served as a barrier to the transported windblown dust.

FIGURE 5-13
BRAWLEY PM₁₀ CONCENTRATIONS & WIND SPEED CORRELATION

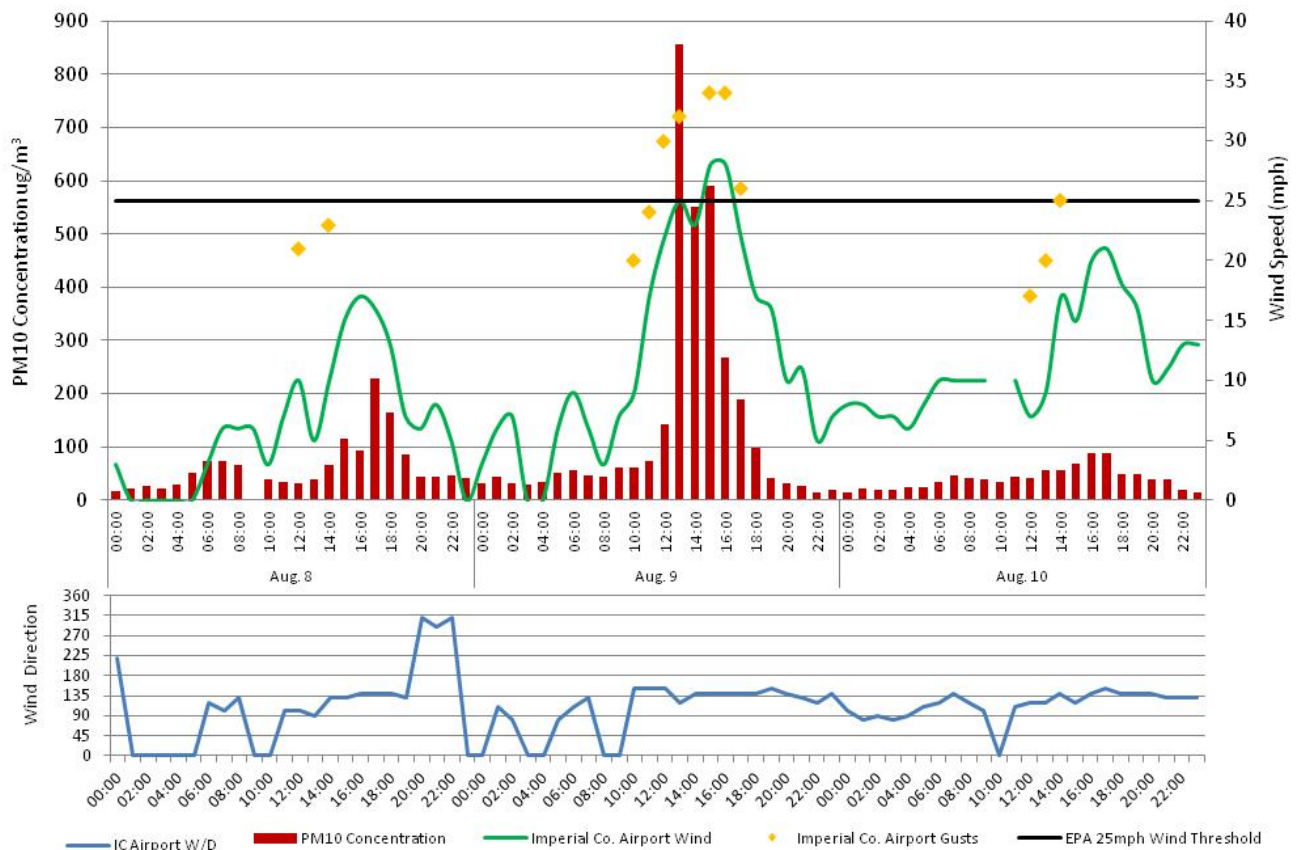


Fig 5-13: Fluctuations in hourly concentrations over 72 hours show a positive correlation with wind speeds, particularly gusts, at Imperial County Airport (KIPL). The Brawley station does not measure wind. Black line indicates 25 mph threshold. Air quality data from the EPA's AQS data bank. Wind data from the NCEI's QCLCD system

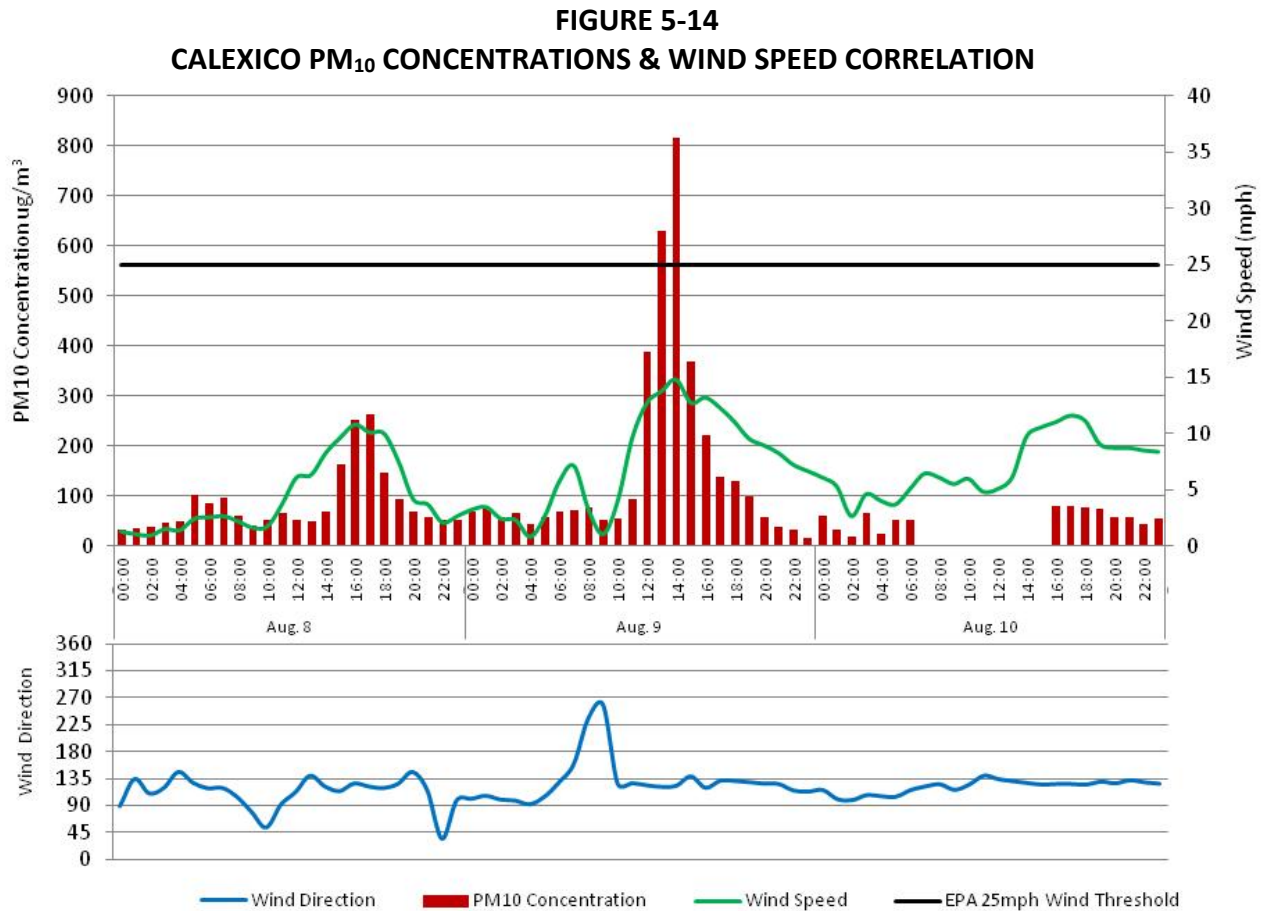


Fig 5-14: Winds at Calexico remained at moderate levels however, gusts, which is not measured by the Calexico station, played a significant role in causing windblown dust to affect air quality and the air monitors in Imperial County. Black line indicates 25 mph threshold. Air quality and wind data from the EPA's AQS data bank

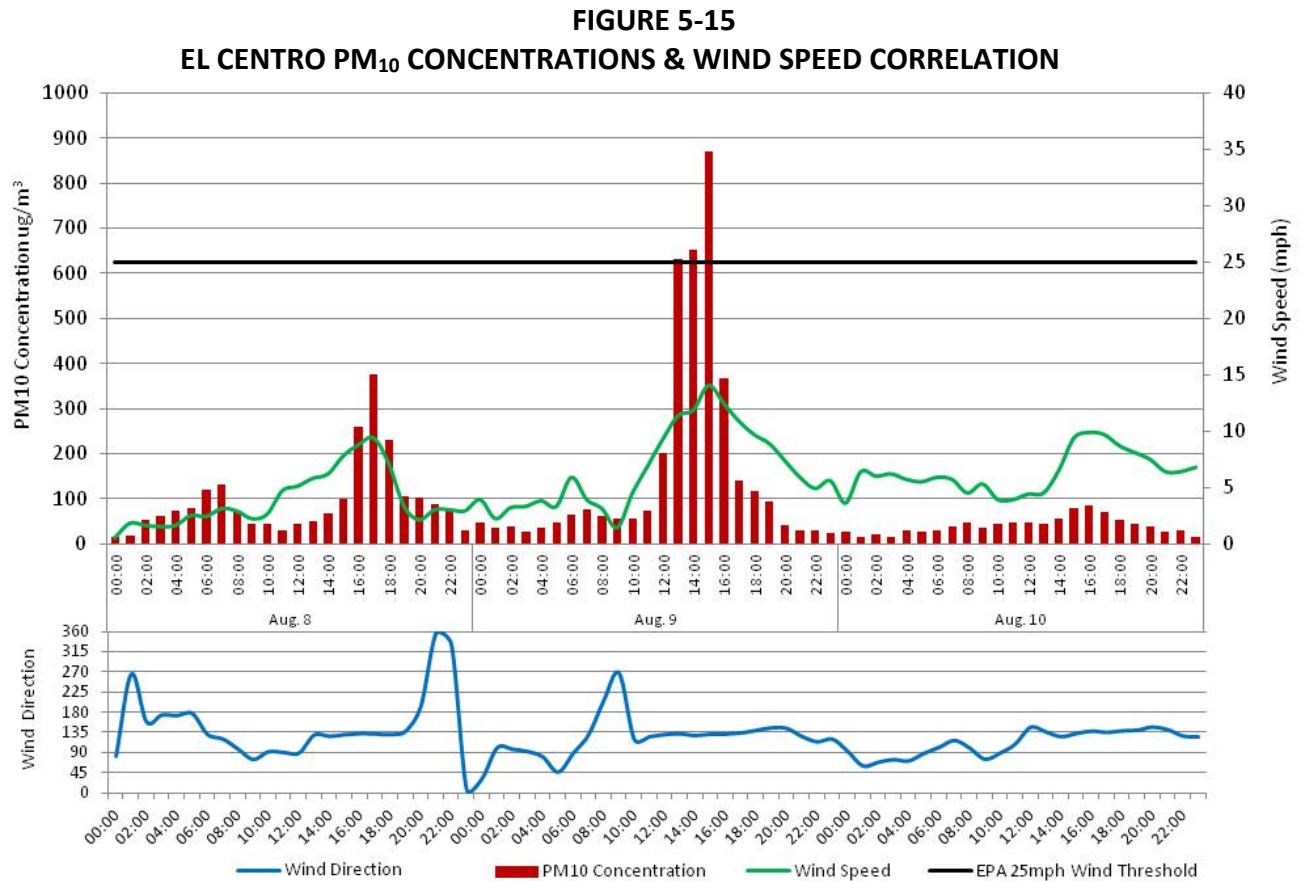


Fig 5-15: Note that winds at El Centro remained at moderate levels however, gusts, not measured by the El Centro station, played a significant role in causing windblown dust to affect air quality and the air monitors in Imperial County. Black line indicates 25 mph threshold. Air quality and wind data from the EPA's AQS data bank

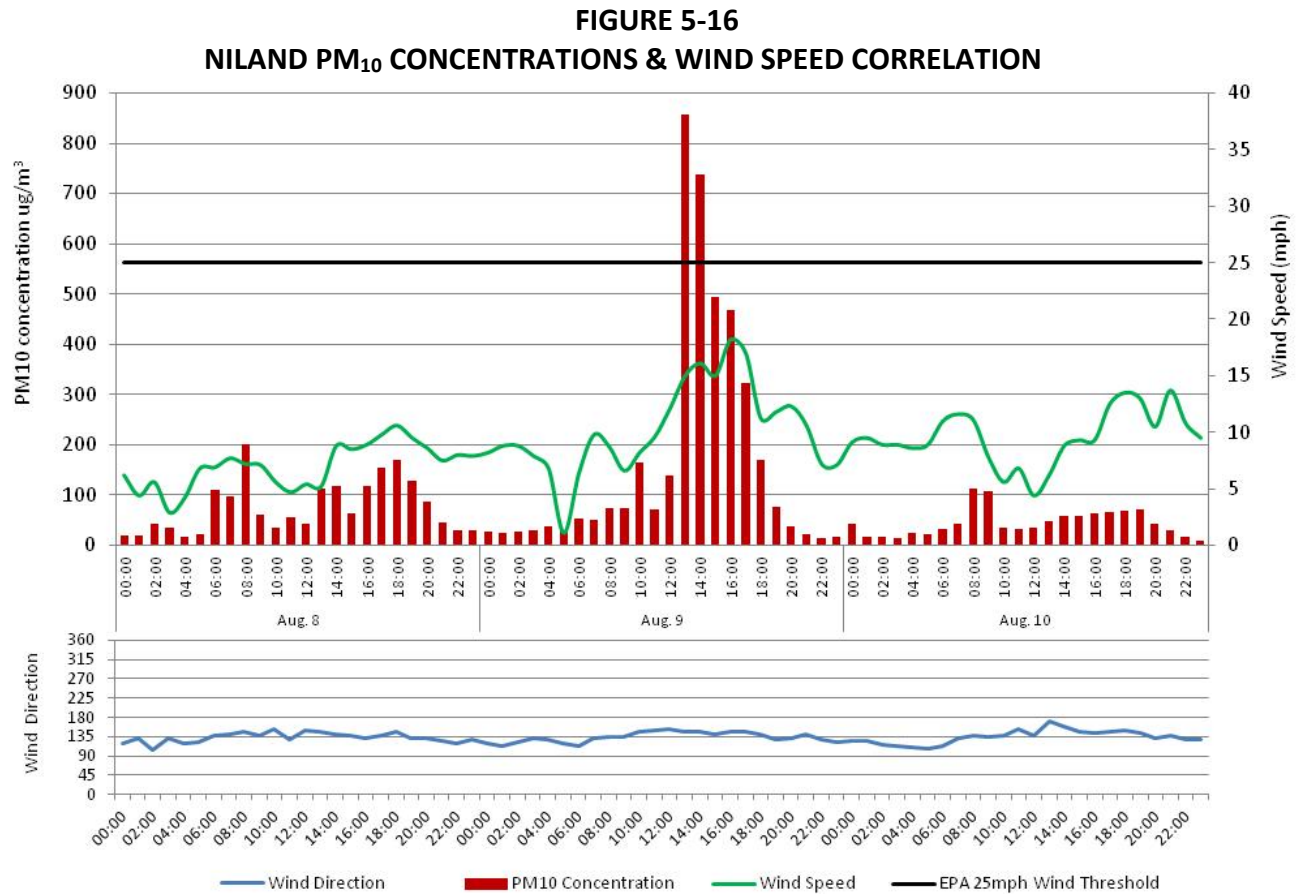


Fig 5-16: Winds at Niland elevated to moderate levels however, gusts, which is not measured by the Niland station, played a significant role in causing windblown dust to affect air quality and the air monitors in Imperial County. Black line indicates 25 mph threshold. Air quality and wind data from the EPA's AQS data bank

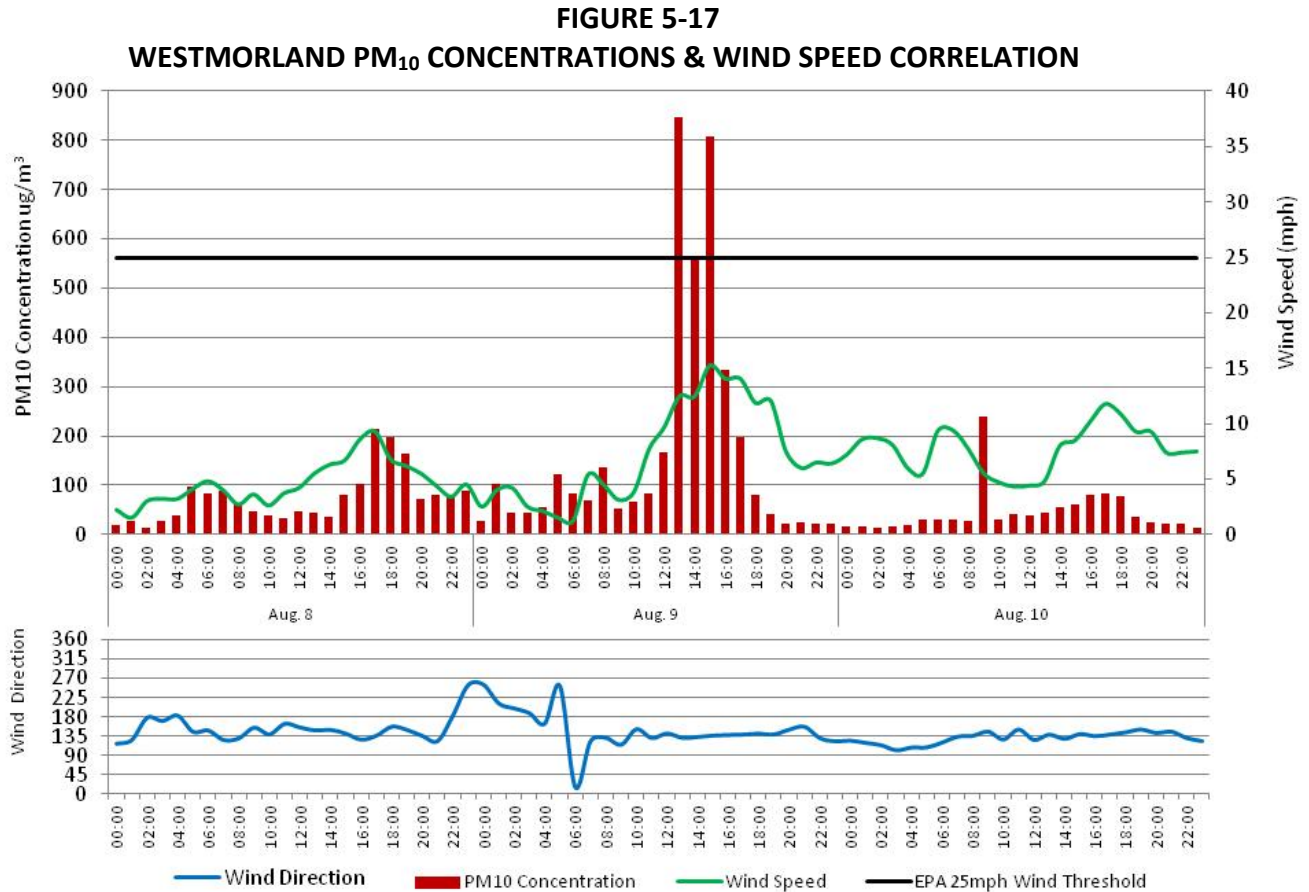


Fig 5-17: Winds at Westmorland remained at moderate levels however, gusts, which is not measured by the Westmorland station, played a significant role in causing windblown dust to affect air quality and the air monitors in Imperial County. Black line indicates 25 mph threshold. Air quality and wind data from the EPA's AQS data bank

Figure 5-18 depicts the relationship between the 72-hour PM₁₀ fluctuations by the Brawley, Calexico, El Centro, Niland, and Westmorland monitors together with upstream wind speeds. A positive correlation can be seen, between an increase in wind speeds and gusts with increased concentrations at the monitors. **Appendix C** contains additional graphs illustrating the relationship between PM₁₀ concentrations and wind speeds from region monitoring sites within Imperial County, eastern Riverside County, and Yuma, Arizona during the wind event.

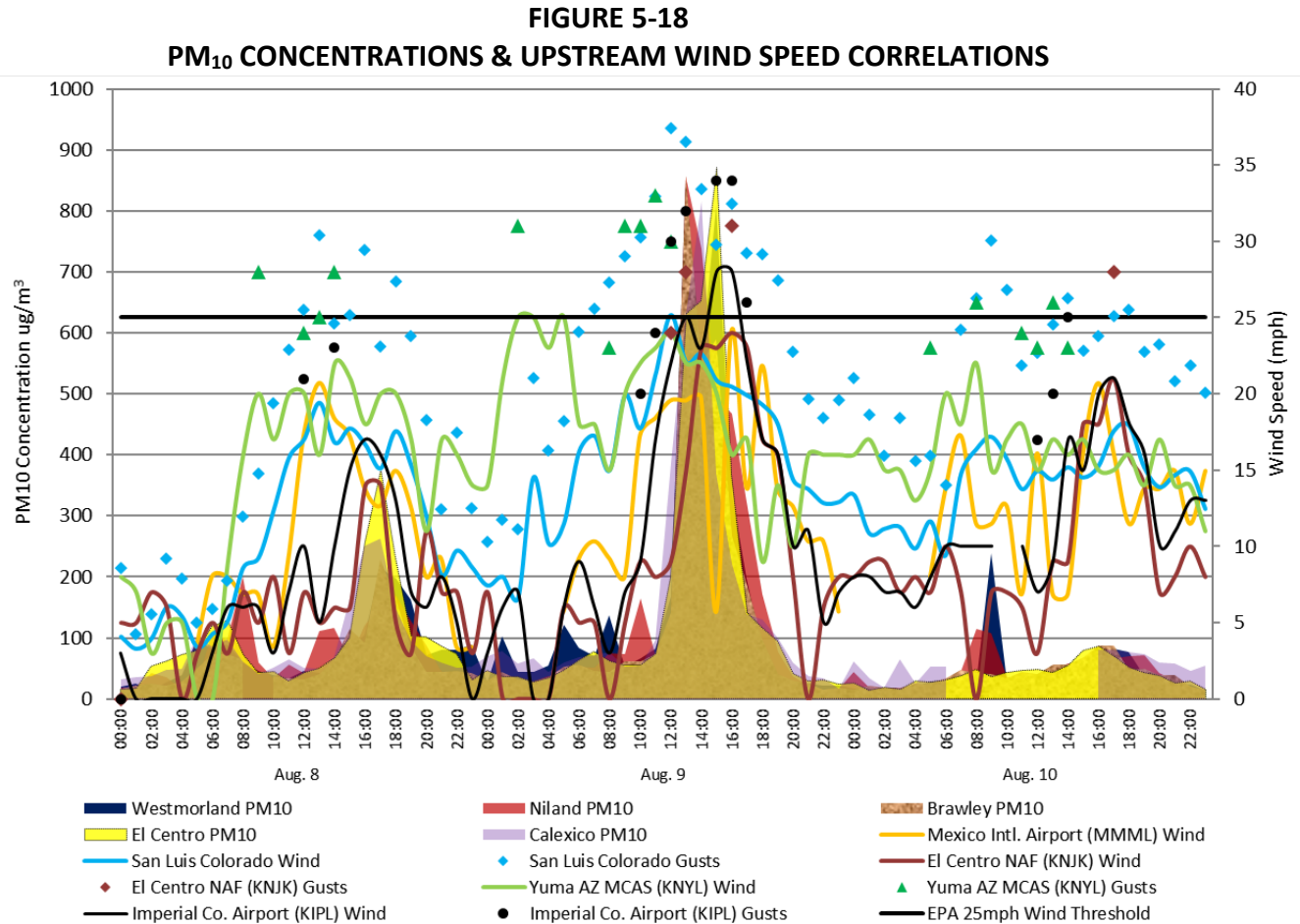


Fig 5-18: This graph depicts the 72-hour PM₁₀ fluctuations by the Brawley, Calexico, El Centro, and Westmorland monitors together with upstream wind speeds. A positive correlation between an increase in wind speeds can be seen, particularly with gusts. Black line indicates the 25 mph threshold

Figure 5-19 compares the 72-hour concentrations at Brawley, Calexico, El Centro, Westmorland, and Niland with visibility²³ at local airports. Drops in visibility correspond generally to highest hourly concentrations at the monitors.

²³ According to the NWS there is a difference between human visibility and the visibility measured by an Automated Surface Observing System (ASOS) or an Automated Weather Observing System (AWOS). The automated sensors measure clarity of the air vs. how far one can “see”. The more moisture, dust, snow, rain, or particles in the light beam the more light scattered. The sensor measures the return every 30 seconds. The visibility value transmitted is the average 1-minute value from the past 10 minutes. The sensor samples only a small segment of the atmosphere, 0.75 feet therefore an algorithm is used to provide a representative visibility. Siting of the visibility sensor is critical and large areas should provide multiple sensors to provide a representative observation; <http://www.nws.noaa.gov/asos/vsby.htm>.

FIGURE 5-19
72-HOUR TIME SERIES PM₁₀ CONCENTRATIONS AND VISIBILITY

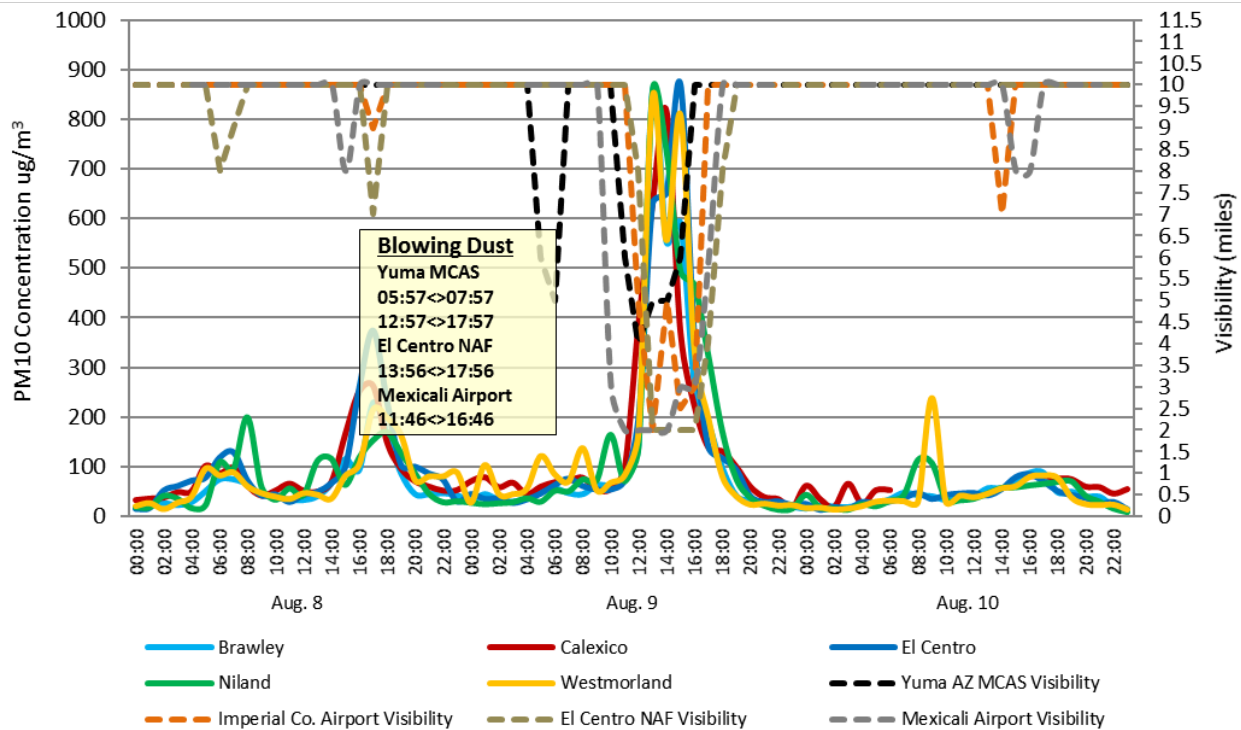


Fig 5-19: Visibility as reported from Mexicali, Mexico International Airport (MMML), Imperial County Airport (KIPL), El Centro NAF (KNJK), and Yuma MCAS (KNYL) shows that visibility dipped significantly at the airfields coincident to peak concentrations at Brawley, Calexico, El Centro, and Westmorland. Visibility data from the NCEI's QCLCD data bank

As discussed above, the Phoenix NWS office included no less than 45 notices, such as Bulletins, Preliminary Storm Reports, Flood Advisories, Urgent Weather Messages and Special Weather Statements attesting to the gusty southerly winds, blowing dust and thunderstorm activity.

Figures 5-20 through 5-23 illustrate the level of the Air Quality Index (AQI) in Calexico, El Centro, Niland and Westmorland.²⁴ In each case, air quality progressively degraded as windblown dust settled. Except for the Calexico monitor the AQI at each monitor reached "Orange" or Unhealthy for Sensitive Groups level (PM₁₀ 101-150 $\mu\text{g}/\text{m}^3$) during the evening hours. Because averaging times for each AQI hour reflects the previous 24 hours, the impact to air quality is extrapolated in accordance with the time dust settles. **Appendix A** contains a copy of notices pertinent to the August 9, 2016 event.

²⁴ The AQI is an index for reporting daily air quality. It tells you how clean or polluted your air is, and what associated health effects might be a concern for you. The AQI focuses on health effects you may experience within a few hours or days after breathing polluted air. EPA calculates the AQI for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. For each of these pollutants, EPA has established national air quality standards to protect public health. Ground-level ozone and airborne particles are the two pollutants that pose the greatest threat to human health in this country. Source: <https://www.airnow.gov/index.cfm?action=aqibasics.aqi>

FIGURE 5-20
IMPERIAL VALLEY AIR QUALITY INDEX IN CALEXICO
AUGUST 9, 2016

Imperial Valley Air Quality

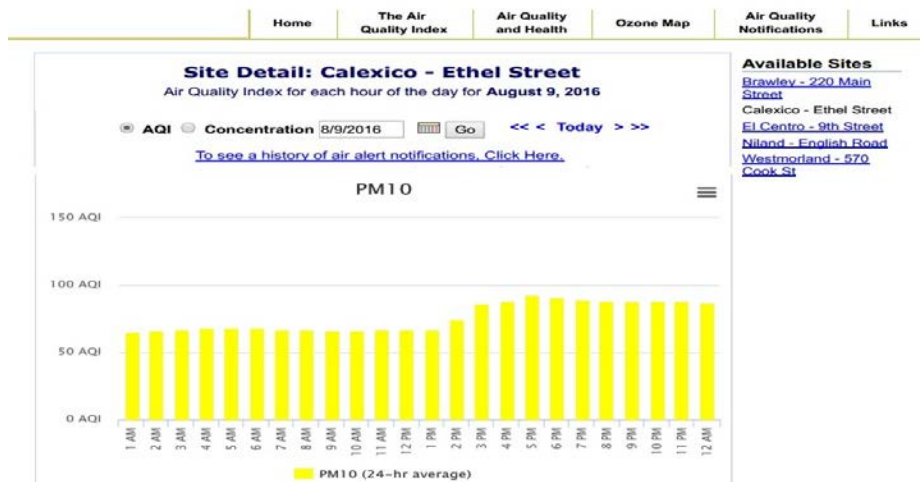


Fig 5-20: Reduced air quality is evident when warnings go from a good or green to moderate or yellow level. Source: ICAPCD archives

FIGURE 5-21
IMPERIAL VALLEY AIR QUALITY INDEX IN EL CENTRO
AUGUST 9, 2016

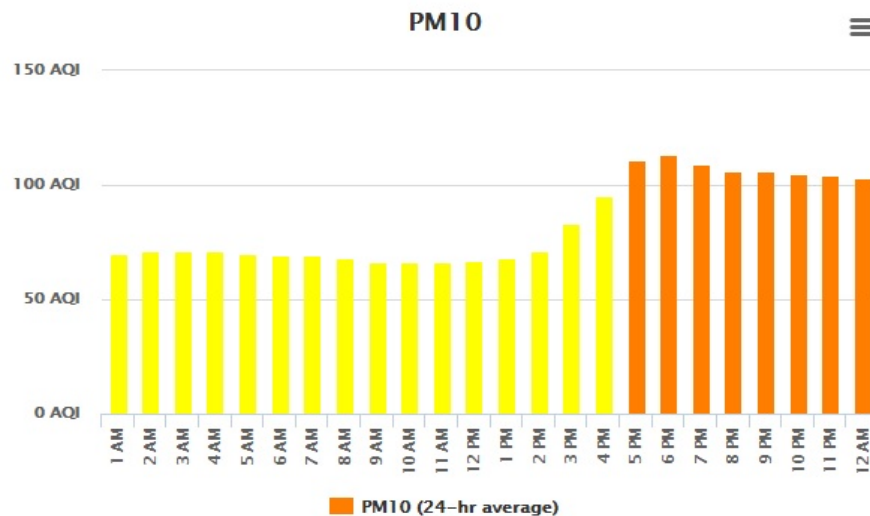


Fig 5-21: Reduced air quality is evident when warnings go from a moderate or yellow to an unhealthy for sensitive groups or orange level. Source. Source: ICAPCD archives

FIGURE 5-22
IMPERIAL VALLEY AIR QUALITY INDEX IN NILAND
AUGUST 9, 2016

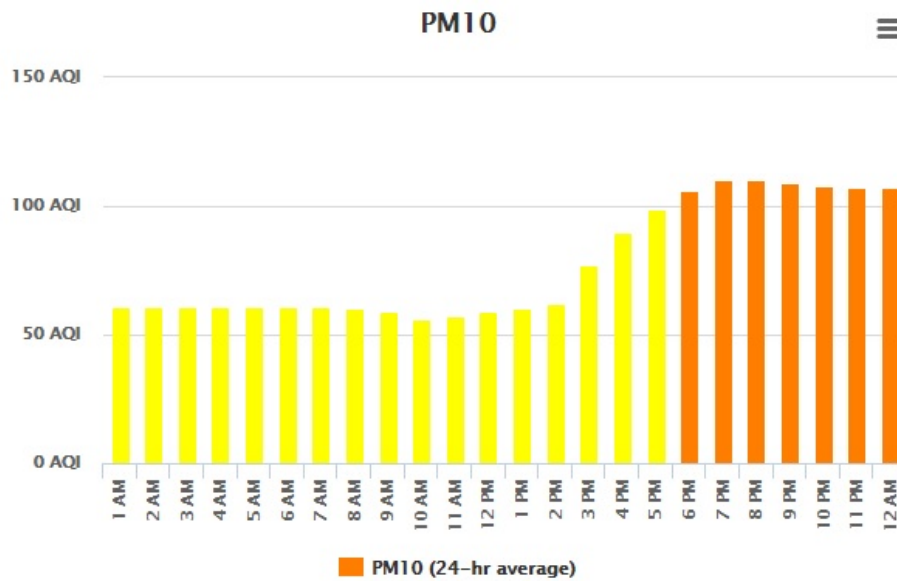


Fig 5-22: Reduced air quality is evident when warnings go from a moderate or yellow to an unhealthy for sensitive groups or orange level. Source: ICAPCD archives

FIGURE 5-23
IMPERIAL VALLEY AIR QUALITY INDEX IN WESTMORLAND
AUGUST 9, 2016

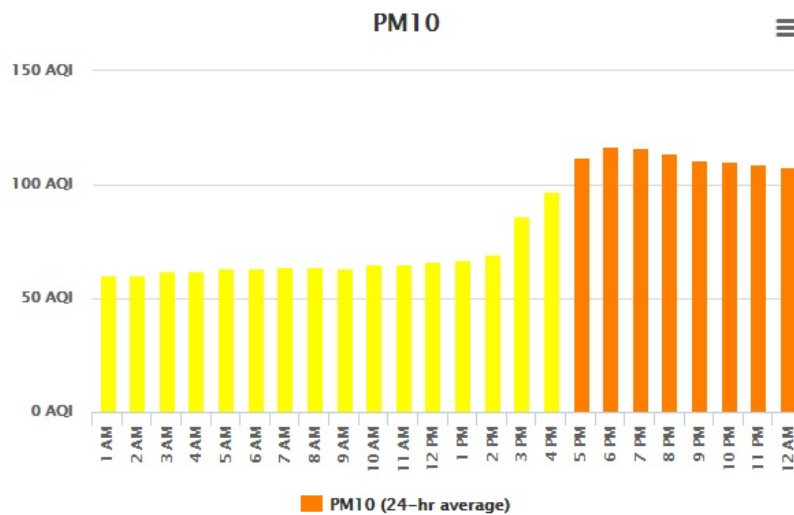


Fig 5-23: Reduced air quality is evident when warnings go from a moderate or yellow to an unhealthy for sensitive groups or orange level. Source: ICAPCD archives

V.2 Summary

The preceding discussion, graphs, figures, and tables provide wind direction, speed and concentration data illustrating the spatial and temporal effects of the synoptic-scale flow around the base of the low-pressure trough over the western United States that drove gusty southerly winds, created by ideal meteorological conditions for monsoonal activity within the desert southwest, on August 9, 2016. The information provides a clear causal relationship between the transported windblown dust and the PM₁₀ exceedance measured at the Calexico, El Centro, Niland, and Westmorland monitors on August 9, 2016. Furthermore, the advisories and air quality index illustrate the affect upon air quality within the region extending from the southwest portion of Yuma County, Arizona, all of Imperial County, and the southern portion of Riverside County. Large amounts of coarse particles (dust) and PM₁₀ were transported by gusty southerly winds into the lower atmosphere causing a change in air quality within Imperial County. The windblown dust originated from as far as the natural open desert areas, farmlands and populated centers located within the Sonora State of northern Mexico, Baja California, southwestern Arizona and Imperial County (part of the Sonoran Desert). Combined, the information demonstrates that the elevated PM₁₀ concentrations measured on August 9, 2016 coincided with gusty southerly winds measured over the southern portion of Riverside County, southeastern San Diego County, all of Imperial County, and parts of Arizona.

FIGURE 5-24
AUGUST 9, 2016 WIND EVENT TAKEAWAY POINTS

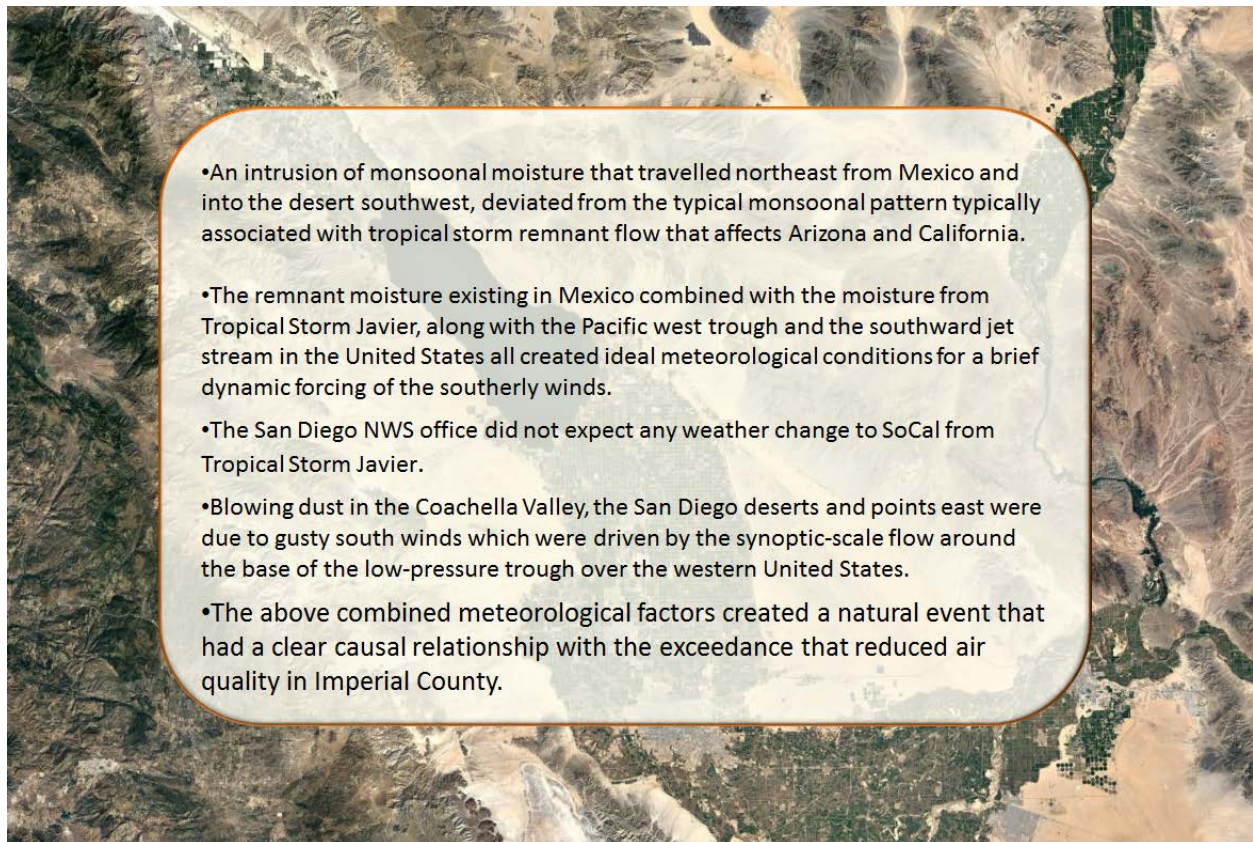


Fig 5-24: Is a summary of the meteorological conditions and facts that qualify the August 9, 2016 event, which affected air quality as an Exceptional Event.

VI Conclusions

The PM₁₀ exceedance that occurred on August 9, 2016, satisfies the criteria of the EER which states that in order to justify the exclusion of air quality monitoring data evidence must be provided for the following elements:

TABLE 6-1 TECHNICAL ELEMENTS CHECKLIST		
EXCEPTIONAL EVENT DEMONSTRATION FOR HIGH WIND DUST EVENT (PM ₁₀)		DOCUMENT SECTION
1	A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s)	6-38; 91
2	A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation	61-89; 90
3	Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times to support the requirement at paragraph (c)(3)(iv)(B) of this section	39-52; 91
4	A demonstration that the event was both not reasonably controllable and not reasonably preventable	53-60; 90
5	A demonstration that the event was a human activity that is unlikely to recur at a particular location or was a natural event	61-89; 90

VI.1 Affects Air Quality

The preamble to the revised EER states that an event is considered to have affected air quality if it can be demonstrated that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation. Given the information presented in this demonstration, particularly Section V, we can reasonably conclude that there exists a clear causal relationship between the monitored exceedance and the August 9, 2016 event which changed or affected air quality in Imperial County.

VI.2 Not Reasonably Controllable or Preventable

In order for an event to be defined as an exceptional event under section 50.1(j) of 40 CFR Part 50 an event must be “not reasonably controllable or preventable.” The revised preamble explains that the nRCP has two prongs, not reasonably preventable and not reasonably controllable. The nRCP is met for natural events where high wind events entrain dust from desert areas, whose sources are controlled by BACM, where human activity played little or no direct

causal role. This demonstration provides evidence that despite BACM in place within Imperial County, high winds overwhelmed all BACM controls where human activity played little to no direct causal role. The PM₁₀ exceedance measured at the Calexico, El Centro, Niland, and Westmorland monitors were caused by naturally occurring strong gusty west winds that transported fugitive dust into Imperial County and other parts of southern California from areas located within the Sonoran Desert regions of northern Mexico to the south of Imperial County. These facts provide strong evidence that the PM₁₀ exceedances at Calexico, El Centro, Niland, and Westmorland on August 9, 2016, were not reasonably controllable or preventable.

VI.3 Natural Event

The revised preamble to the EER clarifies that a “Natural Event” (50.1(k) of 40 CFR Part 50) is an event and its resulting emissions, which may recur at the same location where anthropogenic sources that are reasonably controlled are considered not to play a direct role in causing emissions, thus meeting the criteria that human activity played little or no direct causal role. As discussed within this demonstration, the PM₁₀ exceedances that occurred at Calexico, El Centro, and Westmorland on August 9, 2016, were caused by the transport of fugitive dust into Imperial County by strong southerly winds associated with a mass of monsoonal air that surged northward out of Mexico. At the time of the event anthropogenic sources were reasonably controlled with BACM. The event therefore qualifies as a natural event.

VI.4 Clear Causal Relationship

The time series plots of PM₁₀ concentrations at Brawley, Westmorland, and Niland during different days, and the comparative analysis of different areas in Imperial and Riverside county monitors demonstrates a consistency of elevated gusty west winds and concentrations of PM₁₀ at the Calexico, El Centro, Niland, and Westmorland monitoring stations on August 9, 2016, (Section V). In addition, these time series plots and graphs demonstrate that the high PM₁₀ concentrations and the gusty west winds were an event that was widespread, regional and not preventable. Arid conditions preceding the event resulted in soils that were particularly susceptible to particulate suspension by the elevated gusty west winds. Days immediately before and after the high wind event PM₁₀ concentrations were well below the NAAQS. Overall, the demonstration provides evidence of the strong correlation between the natural event and the entrained fugitive emissions to the exceedances on August 9, 2016.

VI.5 Historical Concentrations

The historical annual and seasonal 24-hr average PM₁₀ values measured at the Calexico, El Centro, Niland, and Westmorland monitors were historically unusual compared to a multi-year data set (Section III).

Appendix A: Public Notification that a potential event was occurring (40 CFR §50.14(c)(1))

This section contains wind advisories issued by the National Weather Service and Imperial County on or around August 9, 2016. In addition, this Appendix contains the air quality alert issued by Imperial County advising sensitive receptors of potentially unhealthy conditions in Imperial County resulting from the strong gusty winds. The data show a region-wide increase in wind speeds and wind gusts coincident with the arrival of dust and high PM₁₀ concentrations in Imperial County.

Appendix B: Meteorological Data.

This Appendix contains the time series plots, graphs, wind roses, etc. for selected monitors in Imperial and Riverside Counties. These plots, graphs and tables demonstrate the regional impact of the wind event.

Appendix C: Correlated PM₁₀ Concentrations and Winds.

This Appendix contains the graphs depicting the correlations between PM₁₀ Concentrations and elevated wind speeds for selected monitors in Imperial and Riverside Counties. These graphs demonstrate the region wide impact of the wind event.

Appendix D: Regulation VIII – Fugitive Dust Rule.

This Appendix contains the compilation of the BACM adopted by the Imperial County Air Pollution Control District and approved by the United States Environmental Protection Agency. A total of seven rules numbered 800 through 806 comprise the set of Regulation VIII Fugitive Dust Rules.